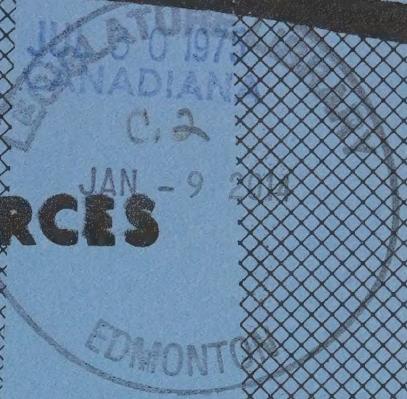


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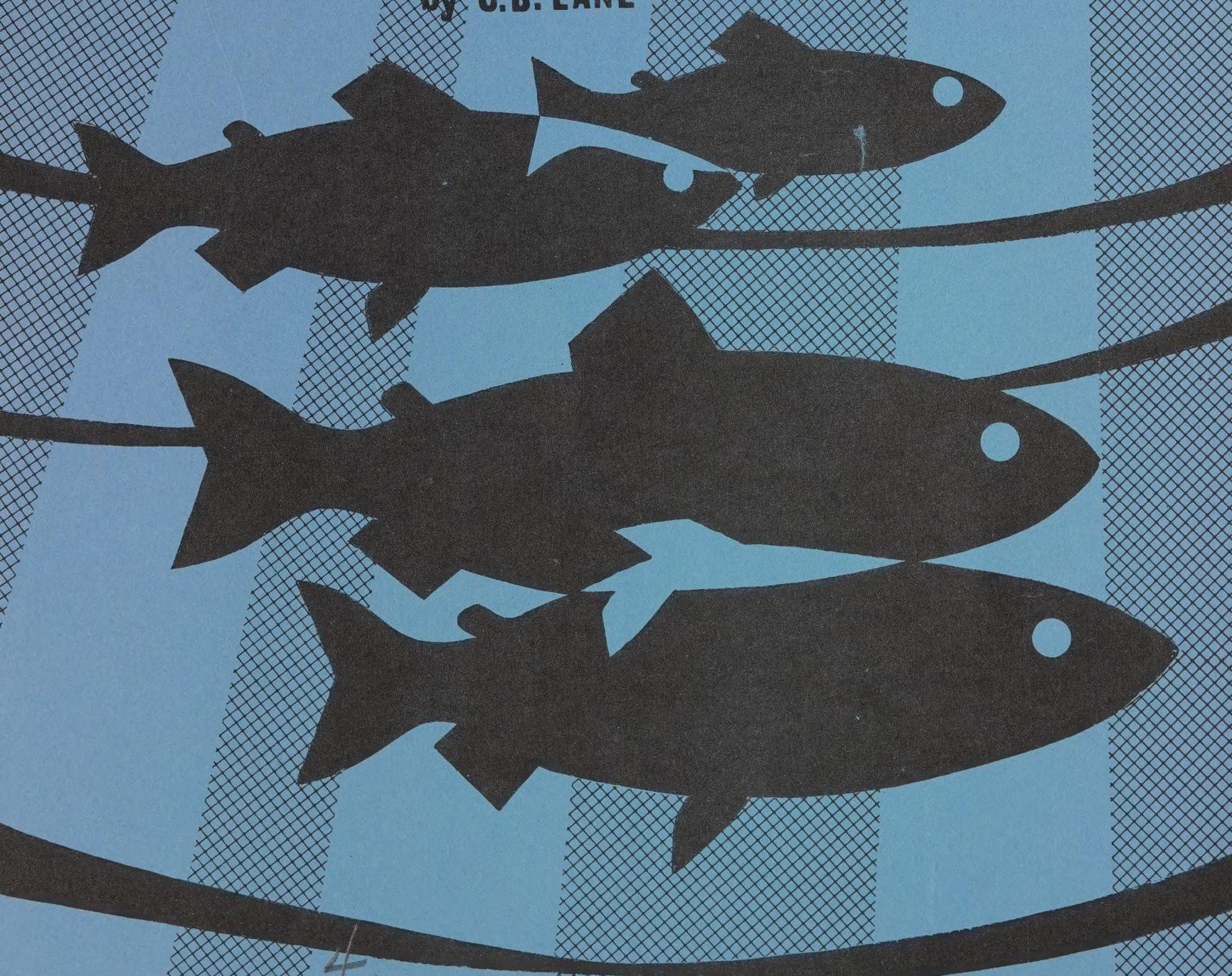
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A SURVEY OF THE FISHERY RESOURCES OF ISLE, LAC STE. ANNE AND MATCHAYAW OR DEVILS LAKES, 1969

by C.B. LANE



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Alberta Fish and Wildlife Division
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A SURVEY OF THE FISHERY RESOURCES OF
ISLE, LAC STE. ANNE AND MATCHAYAW OR
DEVILS LAKES, 1969.

BY

C. B. LANE

REGIONAL FISHERY BIOLOGIST

FEBRUARY, 1971

FISH AND WILDLIFE DIVISION

DEPARTMENT OF LANDS AND FORESTS



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A SURVEY OF THE FISHERY RESOURCES OF ISLE, LAC STE. ANNE,
AND MATCHAYAW OR DEVILS LAKES, 1969.

Introduction

The Sturgeon River Basin is located in the central portion of Alberta (Figure I). The basin has an area of approximately 925 square miles or 590,000 acres. There are three important and readily accessible fishing lakes on the river system - Lake Isle, Lac Ste. Anne and Matchayaw or Devils Lake. The close proximity of these lakes to major population centers, particularly the city of Edmonton, make it a focal point for application of developmental schemes designed to produce optimum utilization of existing resources. Present, water utilization demands upon the Sturgeon River system include recreation, municipal, industrial, irrigation, and pollution abatement. Largely uncontrolled water and land use has rendered the Sturgeon River itself virtually useless as a fishery and has reduced the capabilities of the lakes on the river to produce fish. Water utilization demands will necessarily increase because of the anticipated rate of population growth for this area.

Because of the obvious need for a comprehensive water development plan for the Sturgeon River Basin a special program has been established entitled "The Sturgeon River Basin Development Study." This governmental study is interdepartmental in scope and designed to ensure that both short term and long term water needs are met. The coordinating agency is the Alberta Division of Water Resources.

The fishery survey of Lake Isle, Lac Ste. Anne and Devils Lake was carried out from June to September, 1969. A portion of the

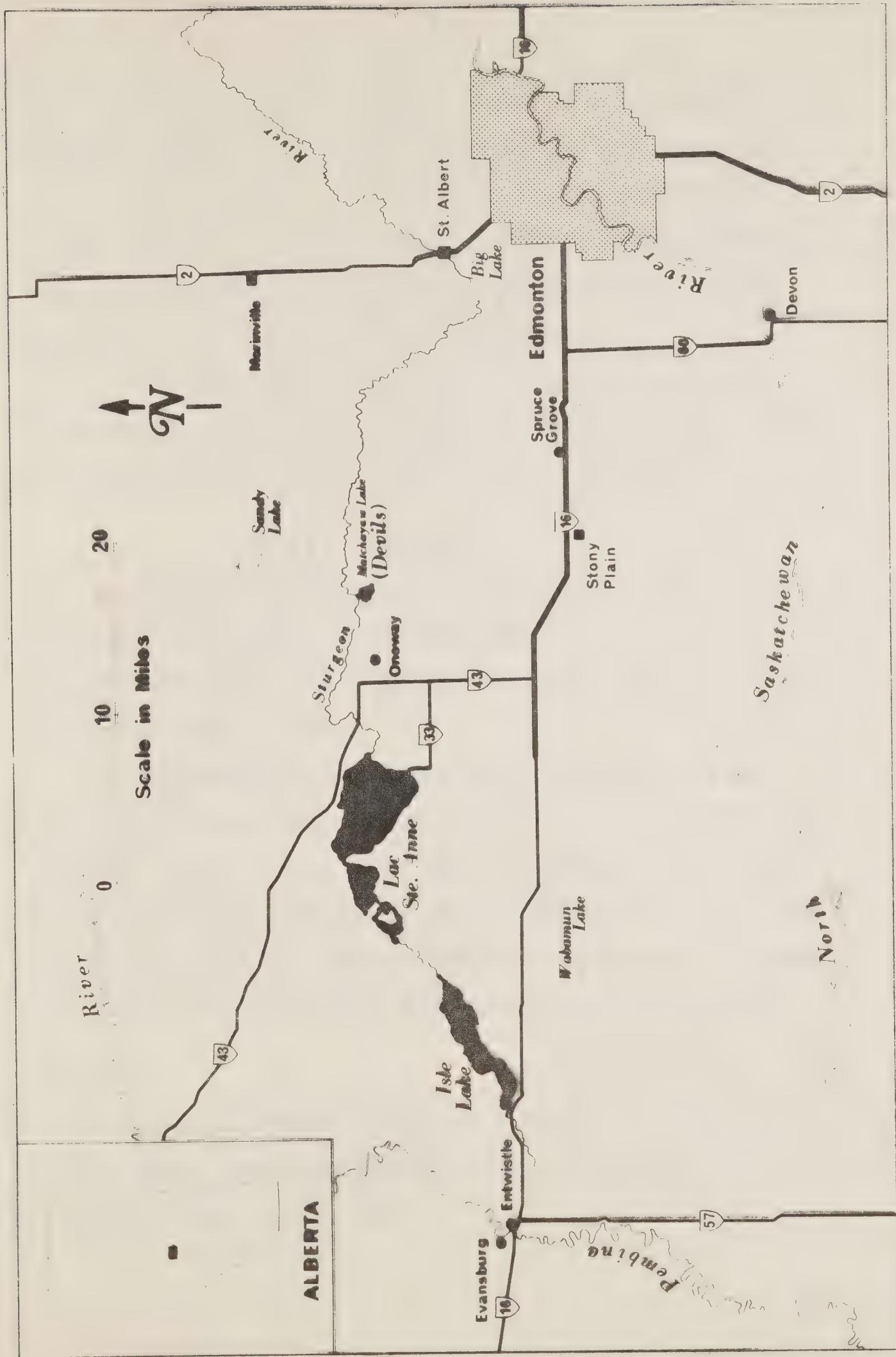


Figure 1 Location of Survey Area

information obtained has already been summarized and published as part of the Fish and Wildlife Division's contribution to the basin study¹.

The geography of the survey area is described in various progress reports of inputs into the Sturgeon River Basin Development Study. The information can be obtained from the Division of Water Resources and will not be included in this report.

The field work for the survey was capably carried out by George Sterling and Victor Snyder, regional summer assistants. Funds for the project were provided by the Division of Water Resources.

Methods

Pertinent morphometrical characteristics were derived from hydrographic maps prepared by the Water Resources and Fish and Wildlife Divisions. Records of changes in water level were also obtained from the Water Resources Division.

Measurements of temperature, dissolved oxygen, pH, and transparency were obtained twice per month from stations located in the deepest portion of each lake. Sampling stations are designated on hydrographic maps. Two stations were established on Lac Ste. Anne. Temperature readings were obtained with a Whitney Electric Thermometer Model TC-10. The Miller Method was employed to measure dissolved

1

A survey of the fishery and wildlife resources of the Sturgeon River Basin, May through September, 1969. Division of Fish and Wildlife, Edson Region, 1969.

oxygen and a Hellige Pocket Comparator was used to determine pH. Measurements of transparency were obtained with a standard Secchi Disc.

Samples of plankton were collected on the same occasions as the physical-chemical measurements were made. A nylon Wisconsin - style net, 12 centimeters in diameter, constructed of Number 20 mesh having 173 threads to the inch, was used to take the samples. Perpendicular, 20-foot tows were made. Duplicate collections were obtained in each instance. Samples were preserved in 10 percent formalin. Subsamples of each collection were examined under the microscope. Relative abundance of observed genera was recorded. The volume of plankton in each sample was also determined.

Samples of bottom fauna were taken from various depths and substrate types with a six-inch Ekman Dredge. The bottom substrate was washed through a series of screens having 8, 16, and 32 meshes per lineal inch, respectively. Organisms were preserved in formalin. Average wet and dry weight, volume, qualitative composition and average number per square foot were determined for each sample.

A 300-yard gang of nylon gill nets, consisting of equal lengths of 1½-, 2-, 3-, 4-, 5-, and 5½-inch stretch mesh, was used to sample larger fish. The nets were set on the lake bottom, at various depths, for 18-24 hours. Smaller fish were collected with a 30-foot seine having $\frac{1}{4}$ -inch mesh.

Representative numbers of fish of each species were measured (fork length) weighed and sexed. Scale samples were taken to age fish. Food organisms were identified and recorded as percentages of total volume.

Morphometry

Lake Isle

A hydrographic map of lake Isle is shown in Figure II and a summary of its morphometry appears in Table 1. The surface area approximates 9.1 square miles or 5,800 acres. Maximum recorded depth at the time of sounding (July, 1963) was 31.0 feet. Mean depth was calculated to be 14.1 feet. About 77 percent of the lake is 20 feet or less in depth. Isle Lake constitutes the head of the Sturgeon River System.

Lac Ste. Anne

The hydrographic map of Lac Ste. Anne is shown in Figure III and its physical characteristics summarized in Table 1. The lake can readily be divided into east and west bays. The area of the total lake approximates 22 square miles or 14,000 acres. The east bay is the larger portion of the lake having an area of nearly 17 square miles. Maximum depth recorded at the time of sounding (June, 1965) was 32 feet. The average depth of the entire lake was calculated to be 16.1 feet. Only 17 percent of the west bay is over 20 feet deep. The east basin is deeper having 44 percent of its area over 20 feet deep. The Sturgeon River enters the lake at the west end and flows out the east end.

Devils Lake

Figure IV is the hydrographic map of Devils Lake. Pertinent morphometric characteristics are presented in Table 1. Surface area is 198 acres. The maximum depth obtained was 35 feet. The calculated



Figure II; Hydrographic Map of Isle Lake

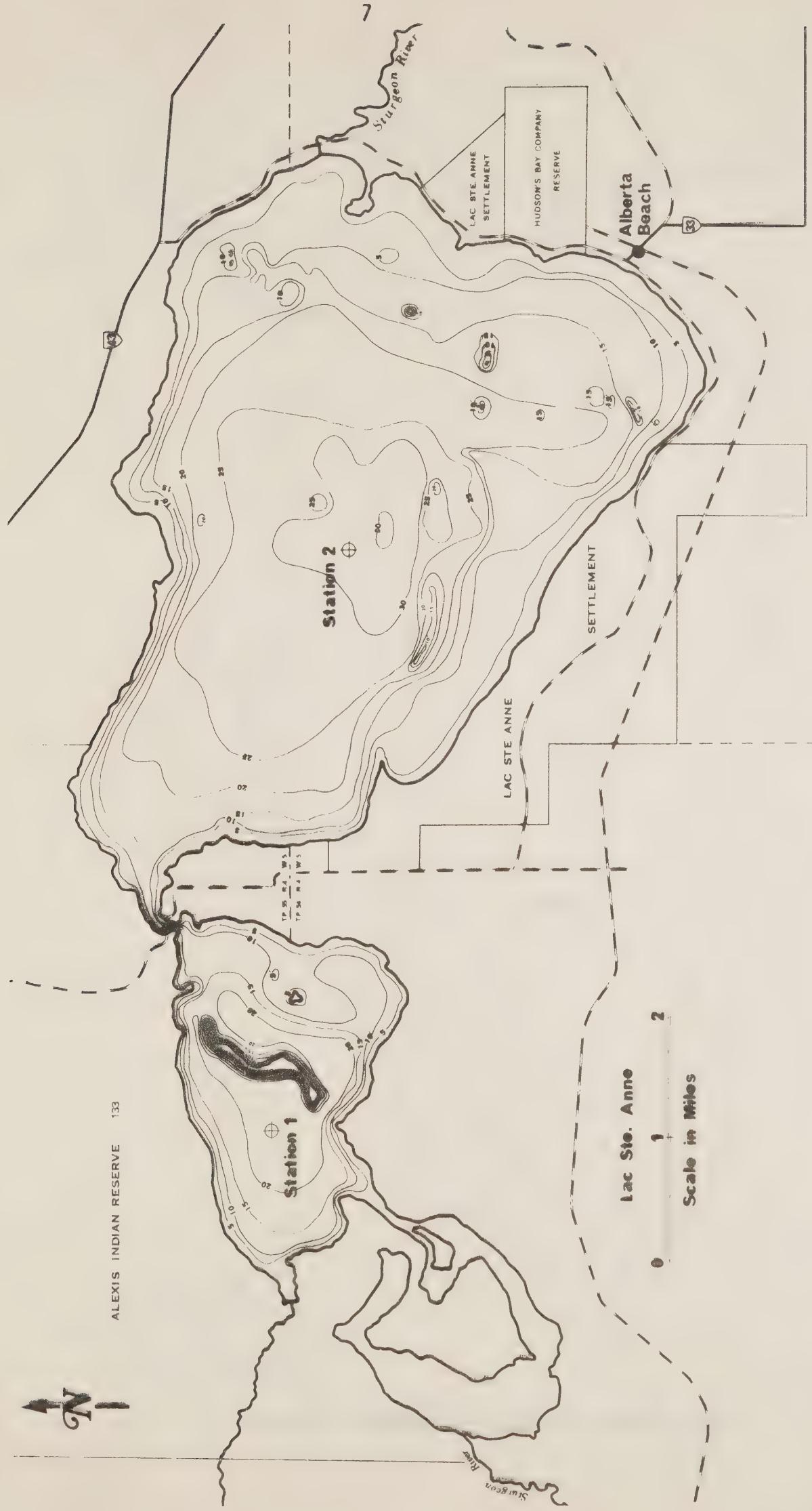


Figure III Hydrographic Map of Lac Ste. Anne

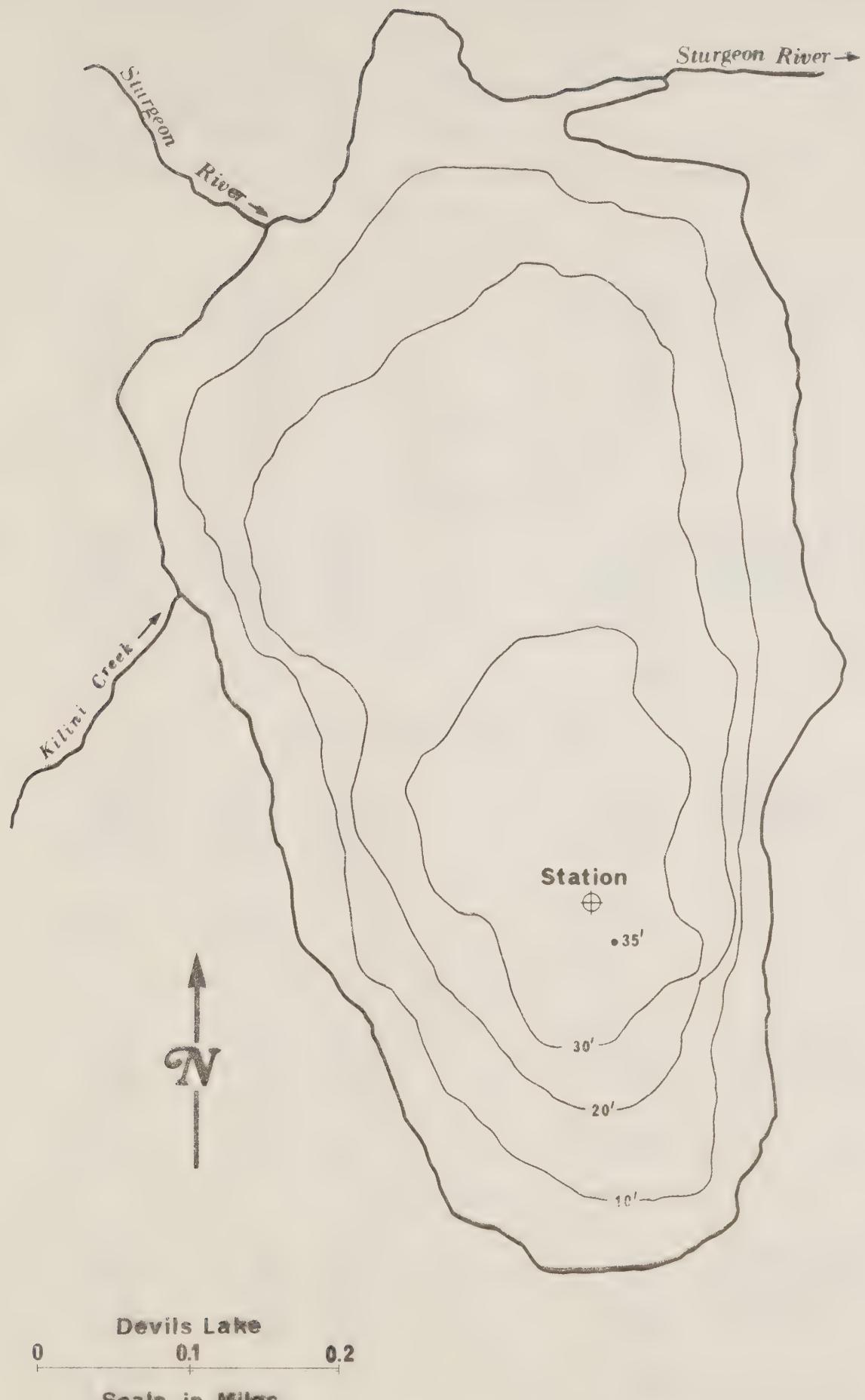


Figure IV Hydrographic Map of Devils Lake

Table 1. Morphometrical characteristics of three lakes on the Sturgeon River, 1969.

Depth Zone, ft.	Area			Volume, acre-feet	Miscellaneous		
	Water		Islands				
	Square miles	Acres					
Isle Lake							
0-10	2.87	1,837	31.6	-	Maximum depth, ft.: 31.0		
10-20	4.16	2,662	45.7	-	Mean depth, ft.: 14.1		
20-30	2.03	1,299	22.3	-	Length of shoreline, mi.: total 29.3		
30-31	0.04	26	0.4	-	(6) Islands 4.6		
Total	9.10	5,824	-	141	82,117		
Lac Ste. Anne (Entire lake)							
0-10	6.55	4,192	30.1	-	Maximum depth, ft.: 32.0		
10-20	6.84	4,378	31.5	-	Mean depth, ft.: 16.1		
20-30	7.26	4,646	33.4	-	Length of shoreline, mi.: total 42.5		
30-32	1.10	704	5.0	-	(2) Islands 3.8		
Total	21.86	13,990	-	77	225,239		
Lac Ste. Anne (East Bay)							
0-10	4.20	2,688	24.7	-	Maximum depth, ft.: 32.0		
10-20	5.24	3,354	30.9	-	Mean depth, ft.: 17.4		
20-30	6.45	4,128	38.0	-	Length of shoreline, mi.: total 19.5		
30-32	1.10	704	6.4	-			
Total	16.99	10,874	-	-	189,084		
Lac Ste. Anne (West Bay)							
0-10	2.35	1,504	49.4	-	Maximum depth, ft.: 25.0		
10-20	1.60	1,024	33.6	-	Mean depth, ft.: 11.4		
20-25	0.81	518	17.0	-	Length of shoreline, mi.: total 23.0		
Total	4.76	3,046	-	77	35,601 (2) Islands 3.8		
Devils Lake							
0-10	0.09	56	28.6	-	Maximum depth, ft.: 35.0		
10-20	0.08	47	23.6	-	Mean depth, ft.: 18.0		
20-30	0.10	67	33.6	-	Length of shoreline, mi.: total 1.9		
30-35	0.04	28	14.2	-			
Total	0.31	198	-	-	3,569		

mean depth is 18 feet. About 50 percent of the lake is over 20 feet deep. The Sturgeon River enters and leaves the lake at the north end. Kilini Creek enters the lake from the west.

Water Levels

Available water level records are presented in Table 2.

Lake Isle

Stabilization of the water level of Isle Lake has been a problem. Since 1960 there has been a cumulative reduction in level approximating 1.4 feet. During the last decade there have also been significant annual increases and decreases in depth. The consistently low levels of the past several years have aided the process of lake eutrophication.

Lac Ste. Anne

Lac Ste. Anne has been subjected to numerous erratic and significant water level fluctuations during the past 20 years. In 1951 the Water Resources Division constructed an outlet control structure on the Sturgeon River. The occurrence of high water levels in the early 1950's resulted in public agitation to have the structure removed. The control structure then fell into disrepair and presently remains in this condition serving no useful purpose. There are indications that water level fluctuations have adversely affected fish populations and accelerated growth of obnoxious aquatic vegetation.

Table 2. Changes in water level of Isle Lake and Lac Ste. Anne.¹

Isle Lake			Lac Ste. Anne		
Date	Elevation	Cumulative change, feet	Date	Elevation	Cumulative change, feet
8-60	94.46	-	10-50	68.83	-
5-61	93.50	-0.96	10-51	69.15	+0.32
5-62	94.62	+0.16	10-52	70.34	+1.51
7-63	94.64	+0.18	10-53	71.71	+2.88
7-64	93.76	-0.70	10-54	72.46	+3.63
5-65	95.94	+1.48	10-55	70.82	+1.99
6-66	94.16	-0.30	10-56	70.95	+2.12
5-67	93.26	-1.20	10-57	70.44	+1.67
5-68	92.52	-1.94	10-58	70.34	+1.57
5-69	93.11	-1.35	10-59	70.40	+1.63
			10-60	70.61	+1.84
			10-61	69.94	+1.17
			10-62	69.70	+0.97
			10-63	70.80	+2.07
			9-64	70.49	+1.76
			10-65	72.69	+3.96
			10-66	70.79	+2.06
			10-67	69.73	+1.00
			9-68	70.04	+1.31
			10-69	70.48	+1.65

¹

Records from Alberta Water Resources Division.

Devils Lake

There are no available water level records for this lake. However, field observations indicated a drop in level of two to three feet in the last ten years. This loss of water is primarily reflected by rampant growth of aquatic vegetation and disappearance of the fall spawning lake whitefish.

Physical - Chemical Conditions

The results of the field limnological measurements are reported in Appendix Table 1 and summarized in Table 3. Selected temperature and dissolved oxygen profiles appear in Figures V and VI, respectively. The results of the chemical analyses of water samples are shown in Table 4.

Lake Isle

Isle Lake was mixed quite well throughout the summer. No significant thermal stratification occurred. Minimum concentrations of dissolved oxygen near the lake bottom were never at critically low tolerance levels for fish. Transparency decreased rapidly after early June as algal blooms developed. The most unique chemical characteristic observed was a total phosphate concentration of 0.17 ppm.

Lac Ste. Anne

Neither the west bay (Station 1) nor the east bay (Station 2) exhibited significant thermal stratification. Oxygen concentrations at both stations remained above critical levels for fish at all times throughout the summer. Secchi Disc readings in the larger east bay were

Table 3. Summary of physical-chemical conditions in three lakes on the Sturgeon River, June-September, 1969.¹

	Isle	Lac Ste. Anne		Devils		
		Station 1	Station 2			
Water Temperature, ° C.						
Surface:						
Maximum	21.4	19.9	19.5	22.0		
Minimum	17.6	17.4	17.2	16.6		
Mean	19.2	18.8	18.5	19.0		
Bottom:						
Maximum	18.1	18.3	17.2	17.5		
Minimum	14.7	15.0	14.0	11.4		
Mean (July-August)	17.3	17.7	17.0	15.6		
Dissolved Oxygen, c.c./l.						
Surface:						
Maximum	8.9	10.0	6.1	12.2		
Minimum	4.9	4.9	4.6	5.2		
Mean	6.4	6.3	5.2	8.3		
Bottom:						
Maximum	4.9	4.4	4.9	1.3		
Minimum	2.8	2.3	1.3	0.3		
Mean (July-August)	3.4	4.1	4.4	1.2		
pH						
Surface:						
Maximum	9+	9+	8.6	9+		
Minimum	8.4	8.4	8.1	9.0		
Mean	8.9	8.8	8.4	9.1		
Bottom:						
Maximum	9+	9+	8.5	8.8		
Minimum	7.7	7.4	7.5	7.5		
Mean	8.4	8.5	8.2	8.2		
Secchi Disc, feet						
Maximum	9.5	6.5	12.5	3.0		
Minimum	1.8	1.3	5.0	1.8		
Mean	4.4	3.4	8.5	2.5		

¹ Field analyses.

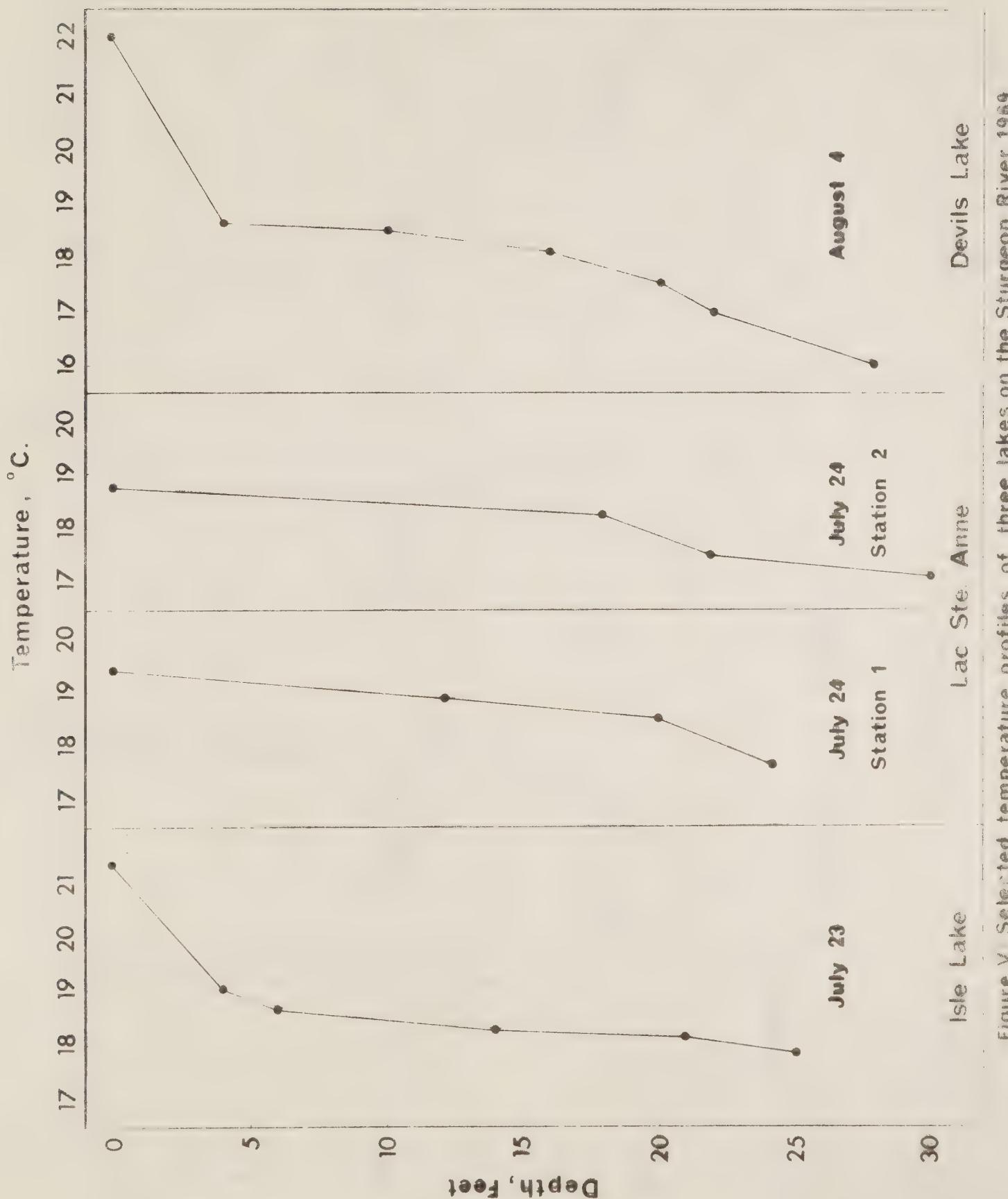


Figure V Selected temperature profiles of three lakes on the Sturgeon River 1969.

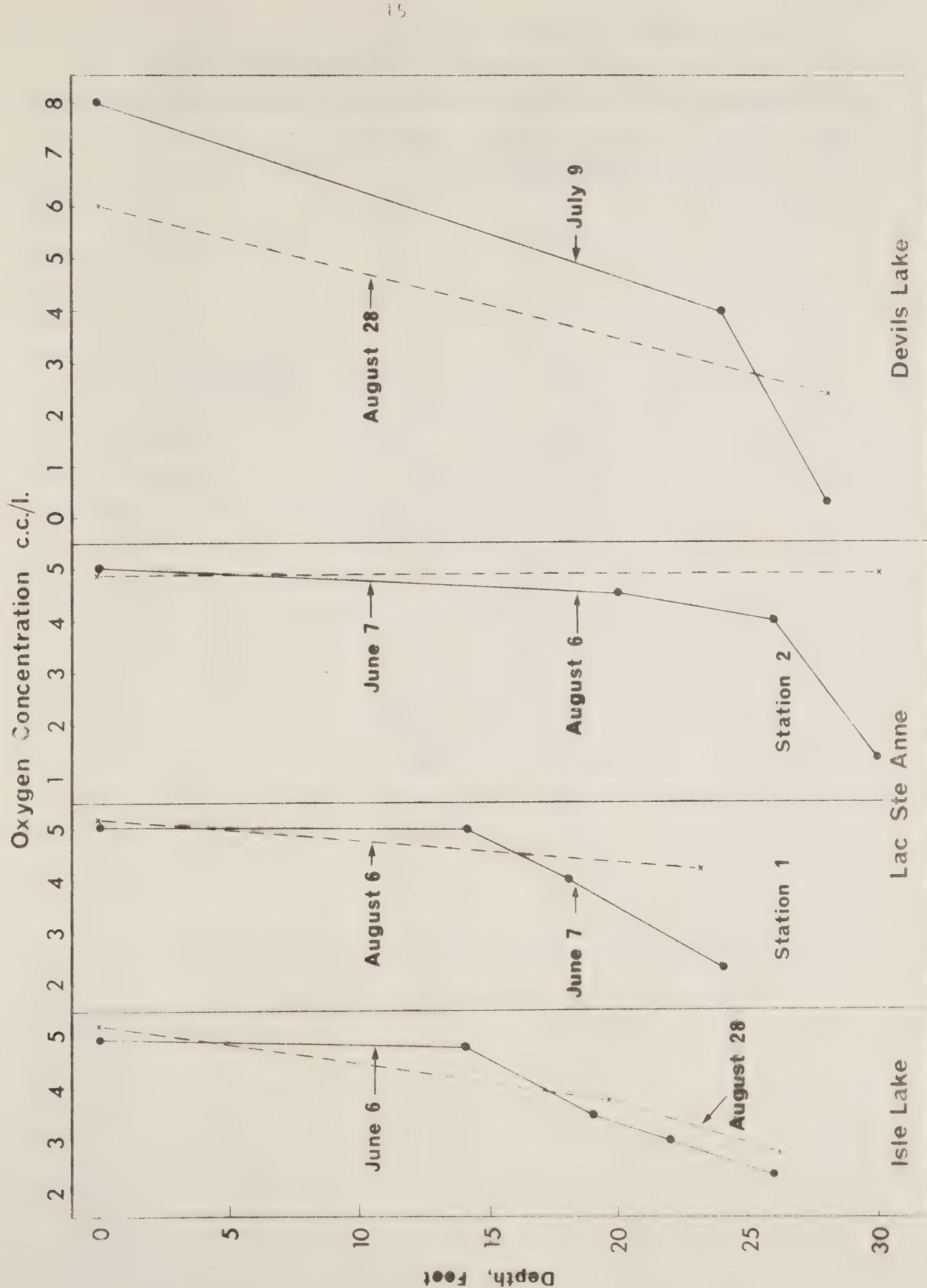


Figure VI - Selected dissolved oxygen profiles from three lakes on the Sturgeon River, 1969.

Table 4 . Chemical analysis of water samples from three lakes on the Sturgeon River, 1969.¹ (Concentrations in parts per million)

	Isle Lake	Lac Ste. Anne (Station 2)	Devils Lake
Total Solids	240	246	424
Conductivity, M. mhos.	240	230	
Ignition Loss	90	90	88
Hardness	120	117	133
Alkalinity (bicarbonate of lime, magnesium and soda)	150	145	230
Nitrite Nitrogen	Trace	Trace	Nil
Nitrate Nitrogen	1.5	1.3	Nil
Sulphates	32	39	105
Chlorides	2	2	2
Phosphates:			
Total	0.17	0.07	0.01
Ortho	0.02	0.03	0.02
Carbonate	3.0	3.0	6.0
Picarbonate	176.9	170.8	268.4
Iron	0.11	0.12	0.18
Sodium	20	20	6.2
Potassium	5.6	5.9	5.8
Silica	10.0	3.2	2.2

¹ Analysis by the Provincial Analyst, University of Alberta, Edmonton, Alberta.

always significantly higher than those in the east bay. Chemically, water from Lac Ste. Anne closely resembles water from Lake Isle except for the difference in phosphate and silica concentration. The concentrations of the constituents measured appear quite ordinary for a lake in this locality.

Devils Lake

Devils Lake, while not exhibiting definite thermal stratification, possessed concentrations of dissolved oxygen, in its deeper water, that were below the critical level of survival for fish. Stagnation of water deeper than 25 feet persisted for most of the summer. It is likely that this oxygen depletion results mainly from a high biochemical oxygen demand in the deep water. Secchi Disc readings indicated that light penetration was poor because of very heavy growths of phytoplankton. The laboratory chemical analysis indicated Devils Lake to be much more eutrophic than either Lake Isle or Lac Ste. Anne.

Plankton

The observed relative abundance and volumes of plankton samples are presented in Tables 5 and 6, respectively.

Lake Isle

The standing crop of plankton was, in general, dominated by blue-green algae, particularly Aphanizomenon. Heavy "blooms" of this genus were observed from late June through late August. When these "blooms" occurred other planktonic organisms became scarce. Zooplankters were most abundant during the spring but were found in all the collections. The volumes of the samples ranged from 0.6 to 5.4 milliliters.

Table 5 . Relative abundance of observed genera of plankton in three lakes on the Sturgeon River, 1969. (++ dominant, + common, - present)

Organism	June 6	June 25	July 9	July 23	August 6	August 28
Isle Lake						
Phytoplankton						
Diatoms:						
<u>Asterionella</u>	++	+	+	-	-	-
<u>Fragilaria</u>	+	+	+	-	-	-
<u>Melosira</u>	-	+	+	-	+	-
<u>Stephanodiscus</u>	-	+	-	-	-	-
Blue-green algae:						
<u>Anabaena</u>	+	++ ¹	++ ¹	++ ¹	++ ¹	+ ²
<u>Aphanizomenon</u>	+	+++	+++	+++	+++	++
<u>Gloeotrichia</u>	+	++	++	-	-	- ²
<u>Microcystis</u>	++	++	++	++	++	+++ ²
Green algae:						
<u>Pediastrum</u>	+	+	+	-	+	-
<u>Selenastrum</u>	+	-	+	-	-	+
Dinoflagellates:						
<u>Ceratium</u>	+	+	+	+	+	+
Zooplankton						
Cladocerans:						
<u>Bosmina</u>	+	-	-	-	-	-
<u>Daphnia</u>	++	+	+	+	+	+
<u>Polypheus</u>	+	+	-	-	-	-
Copepods:						
<u>Cyclops</u>	++	+	+	+	+	+
<u>Diaptomus</u>	++	+	-	+	-	-
<u>Nauplius</u>	+	+	-	+	+	+
Rotifers:						
<u>Keratella</u>	++	+	+	+	+	+
<u>Polyarthra</u>	+	-	-	-	-	-

Organism	June 7	June 26	July 9	July 24	August 6	August 26
Lac Ste. Anne, Station I (West Bay)						
Phytoplankton						
Diatoms:						
<u>Asterionella</u>	+++	+	+	+	+	+

Table 5 continued.

Organism	June 7	June 26	July 9	July 24	August 6	August 26
Lac Ste. Anne, Station I (West Bay) cont'd.						
<u>Fragilaria</u>	++	+	+	++	+	+
<u>Melosira</u>	+	+	+	+	++	++
<u>Stephanodiscus</u>	+	+	+	-	+	+
Blue-green algae:						
<u>Anabaena</u>	++	+++ ¹				
<u>Aphanizomenon</u>	+	+	+	+	++	++
<u>Gloeotrichia</u>	+	+ ¹	+ ¹	- ¹	- ¹	-
<u>Microcystis</u>	++	+++	+++	+++	+++	++
Green algae:						
<u>Pediastrum</u>	+	+	+	+	+	+
<u>Selenastrum</u>	-	+	-	-	-	-
<u>Staurastrum</u>	-	+	+	+	+	+
Yellow-green algae:						
<u>Dinobryon</u>	-	+	-	-	-	-
Dinoflagellates:						
<u>Ceratium</u>	+	++	+++	+++	+++	+++
Zooplankton						
Cladocerans:						
<u>Daphnia</u>	+	+	-	+	+	+
<u>Polypheus</u>	-	-	-	+	-	+
Copepods:						
<u>Cyclops</u>	+++	++	+	+	+	+
<u>Diaptomus</u>	++	++	+	+	+	-
<u>Nauplius</u>	++	++	+	+	+	+
Rotifers:						
<u>Conochilus</u>	+	+	+	-	+	-
<u>Filina</u>	-	-	-	-	-	+
<u>Kellicottia</u>	-	-	-	+	+	+
<u>Keratella</u>	+	+	+	+	+	+
<u>Polyarthra</u>	+	+	-	-	-	+
Lac Ste. Anne, Station 2 (East Bay)						
Phytoplankton						
Diatoms:						
<u>Asterionella</u>	++	++	+	+	+	+
<u>Fragilaria</u>	++	++	++	++	+	+
<u>Melosira</u>	++	++	+	++	++	++
<u>Stephanodiscus</u>	+	+	++	+	+	+

Table 5 continued.

Organism	June 7	June 26	July 9	July 24	August 6	August 26
Lac Ste. Anne, Station 2 (East Bay) cont'd.						
Blue-green algae:						
<u>Anabaena</u>	+	+	++	+++ ¹	+	+
<u>Aphanizomenon</u>	+	+	+	+	+	+
<u>Gloeotrichia</u>	+	-	+	+	-	-
<u>Microcystis</u>	+	+	+	++	+	+
Green algae:						
<u>Pediastrum</u>	+	+	+	+	+	+
<u>Staurastrum</u>	-	+	+	+	+	+
Yellow-green algae:						
<u>Dinobryon</u>	-	-	-	-	+	-
Dinoflagellates:						
<u>Ceratium</u>	+	+++	+++	+	+	+
<u>Peridinium</u>	-	-	-	-	-	+
Zooplankton						
Cladocerans:						
<u>Daphnia</u>	+	+	+	+	+	+
Copepods:						
<u>Cyclops</u>	+++	++	+	+	+	+
<u>Diaptomus</u>	++	++	+	+	+++	++
<u>Nauplius</u>	+++	++	+	+	++	+
Rotifers:						
<u>Conochilus</u>	-	+	-	+	-	-
<u>Filina</u>	-	-	-	+	-	-
<u>Kellicottia</u>	+	-	-	+	-	+
<u>Keratella</u>	+	+	+	+	+	+
<u>Polyarthra</u>	-	-	+	+	+	-

Organism	June 17	July 7	July 21	August 4	August 28
Devils Lake					
Phytoplankton					
Blue-green algae:					
<u>Aphanizomenon</u>	++	+++ ¹	+++ ¹	+++ ¹	+++ ¹
<u>Microcystis</u>	+	+	+	+	+

Table 5 continued.

Organism	June 17	July 7	July 21	August 4	August 28
Devils Lake cont'd.					
Zooplankton					
Cladocerans:					
<u>Bosmina</u>	-	+	-	+	-
<u>Daphnia</u>	+	+	+	+	-
<u>Polypheus</u>	-	+	+	-	-
Copepods:					
<u>Cyclops</u>	+	-	-	-	+
<u>Nauplius</u>	+	-	-	-	+
Rotifers:					
<u>Keratella</u>	+	-	-	-	+

¹ Heavy bloom visible.

² Light bloom visible.

Table 6. Volumes of plankton samples from three lakes
on the Sturgeon River, 1969.

Date	Isle	Milliliters Per Sample			Devils	
		Lac Ste. Anne		Station 2		
		Station 1	Station 2			
June 6	1.5	-	-	-	-	
June 7	-	1.5	1.0	-	-	
June 17	-	-	-	-	5.9	
June 25	1.9	-	-	-	-	
June 26	-	2.2	1.2	-	-	
July 7	-	-	-	-	8.9	
July 9	2.4	1.3	0.9	-	-	
July 21	-	-	-	-	21.9	
July 24	5.4	1.2	1.1	-	-	
August 4	-	-	-	-	9.3	
August 6	2.5	1.1	0.7	-	-	
August 26	-	1.4	1.3	-	-	
August 28	0.6	-	-	-	3.6	
Average	2.3	1.3	1.0	-	9.9	

The peak volume occurred during late July. The mean volume was 2.3 milliliters.

Lac Ste. Anne

Algal "blooms" appeared more prevalent and intense in the west bay. Sample volumes from Station 1 were consistently larger than those from Station 2 in the east bay. The algae producing the "blooms" consisted mainly of the genera Anabaena and Microcystis. The "blooms" observed in Lake Isle and Devils Lake consisted primarily of another blue-green genus Aphanizomenon. The average and peak volumes obtained were both less than those obtained from Lake Isle. Zooplankton composition at both stations was similar.

Devils Lake

Algal production in Devils Lake exceeds by far production in the two upstream lakes. Dense growths of blue-green algae, mainly Aphanizomenon flourished from late June to September. The only other algal form observed was another blue-green genus, Microcystis. The zooplankton population appeared extremely scarce. Volumes of samples from Devils were several times greater than those from either Isle Lake or Lac Ste. Anne. A maximum volume of 21.9 milliliters was obtained during July. The average volume was 9.9 milliliters.

Bottom Fauna

A complete record of bottom fauna samples is presented in Appendix Table 2. The dredgings are summarized in Table 7. Metric statistics are recorded in Table 7 of the Appendix.

Table 7. Average wet and dry weight, volume, numerical percentages, and average number per square foot of bottom fauna from three lakes on the Sturgeon River, 1969.

Average Number Per Square Foot											
	Average Wet Weight, lbs./ac.	Average Dry Weight, lbs./ac.	Average Volume, m³/ac.	Gasterosteidae	Chironomids	Chobautus	Sphaeritids	Gastropods	Oligochaetes Leeches	Miscellaneous	Total
47	373.1	48.5	6.3	18.0	27.2	45.2	95.6	17.2	2.4	3.6	1.2
Percentage				10.3	15.4	25.8	54.6	9.8	1.4	2.1	0.7
50	575.1	74.8	7.6	62.8	59.2	122.0	86.4	0.2	0.4	8.8	5.6
Percentage				25.9	24.5	50.4	35.6	0.1	0.2	3.7	3.7
26	402.7	52.4	6.1	0.4	-	0.4	86.8	22.8	4.8	5.6	-
Percentage				0.3	-	0.3	68.2	18.1	3.8	4.5	-
76	499.1	64.8	7.2	41.6	38.8	80.4	86.4	8.0	2.0	7.6	5.6
Percentage				20.4	19.2	39.6	42.4	3.9	1.0	3.8	2.8
40	376.3	48.9	4.2	136.4	106.0	242.4	40.0	57.6	0.4	1.2	0.4
Percentage				37.3	29.1	66.4	10.9	15.7	0.1	0.3	0.1

Lake Isle

The average standing crop of bottom fauna was estimated to be 48.5 pounds dry weight per acre. This amount easily exceeds the 8.0 pounds per acre minimum level of eutrophication assigned by Rawson¹. Chironomids dominated the qualitative composition of the samples comprising 54.6 percent of the total. Amphipods contributed 25.8 percent. There were an estimated 175.2 organisms per square foot of bottom substrate.

Lac Ste. Anne

The estimated standing crop for all of Lac Ste. Anne was 64.8 pounds per acre and in this aspect the lake is more productive than Lake Isle. The larger east bay appears to be capable of producing more benthos than the west bay. Estimates of dry weight were 74.8 and 52.4 pounds per acre, respectively. There appears to be a qualitative difference between the organisms populating the two bays. Amphipods comprised 50.4 percent of the number collected from the east bay but only 0.3 percent of the number obtained from the west bay. Chironomids dominated the samples from the west bay comprising 68.2 percent of the total number obtained. Many more Chaoborus larvae were found in the samples from the west bay than in those from the east bay. The estimated average number of organisms per square foot for the entire lake was 203.6.

¹

Rawson, D. S. 1960. A limnological comparison of twelve large lakes in northern Saskatchewan. Limnol. and Oceanog. 5:195-211.

Devils Lake

Standing crop of benthos in Devils Lake was calculated to be 48.9 pounds dry weight per acre and 366 organisms per square foot. Quantitatively, this level of production is quite similar to that in Lake Isle. Numerically, however, the standing crop seems to be about twice that of Lake Isle and over 50 percent greater than Lac Ste. Anne. Amphipods made up 66.4 percent of the total number of organisms collected (large numbers taken in shallow water). Chironomids contributed much less to the benthos population here than in both Lac Ste. Anne and Lake Isle.

Fish

Table 8 indicates the species of fish presently inhabitating the lakes of the Sturgeon River System. The only major species not common to all the lakes is the lake whitefish, Coregonus clupeaformis. The only thriving population of whitefish is found in Lac Ste. Anne. The spottail shiner, Notropis hudsonius, was the main forage species.

The results of test netting are reported in Appendix Table 3 and summarized in Table 9. Growth data are presented in Tables 10 and 11 (metric figures in Appendix). Food preferences of fish are indicated in Table 12.

Lake Isle

Test netting produced an average catch per lift of 139.0 fish weighing 205.6 pounds (Table 9). Approximately 40 percent of these fish were white suckers. Walleye and pike were taken in nearly equal numbers,

Table 8. Species of fish found in three lakes on the Sturgeon River, 1969.

	Isle	Lac Ste.	Anne	Devils
Pike - <u>Esox lucius</u>	X		X	X
Walleye - <u>Stizostedion vitreum</u>	X		X	X
Perch - <u>Perca flavescens</u>	X		X	X
Lake Whitefish - <u>Coregonus clupeaformis</u>	-		X	*
White Suckers - <u>Catostomus commersoni</u>	X		X	X
Burbot - <u>Lota lota</u>	X		X	X
Spottail Shiner - <u>Notropis hudsonius</u>	X		X	X
Brook Stickleback - <u>Eulaea inconstans</u>	**		X	**

* Reported by residents as present but none caught.

** Likely present but none caught.

Table 9. Average numbers, weights and percentages of fish caught in gill nets from three lakes on the Sturgeon River, 1969.

Species	Mesh size, inches										Percent	
	$1\frac{1}{2}$		2		3		4		5		$5\frac{1}{2}$	Totals
	No.	lbs.	No.	lbs.	No.	lbs.	No.	lbs.	No.	lbs.	No. lbs.	No. lbs.
Isle Lake - 5 net lifts												
Pike	4.0	6.3	14.0	15.8	16.6	23.7	1.0	2.9	0.2	0.3	-	35.8
Perch	12.2	1.1	7.6	1.6	4.6	0.3	-	-	2.4	7.7	-	26.8
Walleye	8.4	3.7	18.4	9.7	3.0	9.0	3.4	8.5	0.6	1.5	0.8	34.6
White Suckers	2.6	3.3	0.4	0.1	5.0	5.9	18.6	46.6	12.2	43.8	2.8	11.1
Burbot	-	-	-	-	-	-	-	-	0.2	0.8	-	0.2
Totals	27.2	14.5	40.4	27.2	29.2	38.9	23.0	58.0	15.6	54.0	3.6	14.1
Percent	19.6	7.1	29.1	13.2	21.0	18.9	16.5	28.2	11.2	26.3	2.6	6.9
Lac Ste. Anne - 6 net lifts												
Pike	1.0	1.6	3.5	6.6	10.3	21.1	0.8	2.1	-	-	-	15.6
Perch	8.8	0.9	3.2	0.7	1.2	0.8	-	-	-	-	-	13.2
Walleye	2.2	2.3	10.6	11.1	6.5	10.5	3.5	18.0	1.3	3.3	-	-
Lake Whitefish	1.8	0.7	5.8	2.2	2.3	2.0	2.5	5.9	3.0	8.5	0.7	2.1
White Suckers	-	-	0.2	0.3	1.7	3.4	18.5	43.8	2.7	8.3	0.2	0.1
Burbot	-	-	-	-	-	-	1.0	2.3	-	-	-	-
Totals	13.8	5.5	23.3	20.9	22.0	37.8	26.3	72.1	7.0	20.1	0.9	2.2
Percent	14.8	5.2	25.0	13.2	23.6	23.3	28.0	45.5	7.5	12.7	0.9	1.3

Table 9. Continued.

Species	Mesh size, inches										Percent	
	$1\frac{1}{2}$		2		3		4		5			
	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.		

Devils Lake - 4 net lifts

Pike	1.3	1.3	1.3	1.4	3.3	4.7	-	-	0.5	4.3	-
Perch	9.3	1.1	3.0	0.5	0.3	0.4	-	-	-	-	12.5
Walleye	2.5	0.7	0.8	2.7	0.5	1.1	4.3	12.0	2.0	6.4	0.5
White Suckers	-	-	-	-	0.5	0.9	11.3	27.0	7.3	23.3	1.0
Burbot	-	-	-	-	-	-	0.5	1.3	-	-	0.3
Totals	13.1	3.2	5.1	4.6	4.6	7.1	16.1	40.3	9.8	34.0	1.8
Percent	25.9	3.3	10.1	4.8	9.1	7.4	31.9	41.9	19.4	35.4	3.6

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Table 10. Fork lengths and weights at age of six species of fish from three lakes on the Sturgeon River, 1969.

No. of Annuli	Isle			Lac Ste. Anne			Devils		
	Average length, inches	Average weight, ounces	Sample size	Average length, inches	Average weight, ounces	Sample size	Average length, inches	Average weight, ounces	Sample size
Pike									
0	-	-	-	-	-	-	-	-	-
1	12.4	8.3	10	16.1	17.7	5	-	-	-
2	16.6	20.9	84	18.1	25.4	23	17.3	28.0	18
3	20.5	36.6	26	19.1	30.7	23	19.7	36.0	1
4	22.7	48.5	11	20.8	37.8	28	-	-	-
5	25.9	69.0	3	22.5	47.7	5	-	-	-
6	-	-	-	24.0	57.5	1	-	-	-
7	-	-	-	25.2	60.0	1	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	38.9	254.4	1
Walleye									
0	-	-	-	-	-	-	3.6	0.3	1
1	6.6	1.9	4	7.5	2.5	4	7.1	10.8	5
2	8.8	4.1	96	10.5	7.1	44	-	-	-
3	11.4	13.7	6	13.1	14.4	30	-	-	-
4	15.8	26.8	5	15.3	23.8	7	15.5	24.5	2
5	17.7	35.5	13	17.0	33.9	11	17.7	37.6	4
6	19.4	50.0	11	17.7	37.9	15	18.6	44.3	5
7	20.4	55.7	13	18.7	44.9	19	19.2	47.3	6
8	21.3	62.9	8	19.4	50.1	7	19.8	50.3	10
9	25.6	104.0	1	20.8	60.4	4	20.9	58.1	5
Perch									
0	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-
2	5.2	1.2	24	4.9	1.0	2	5.4	1.3	8
3	6.0	1.9	30	5.6	1.3	25	6.2	2.1	17
4	7.4	3.5	15	6.8	2.4	19	6.9	2.8	4
5	8.4	4.8	7	7.7	3.5	6	-	-	-
6	10.4	9.5	1	9.0	5.7	1	9.8	9.0	1
7	10.6	10.0	2	10.7	10.6	4	-	-	-
8	-	-	-	10.8	10.5	4	-	-	-
9	-	-	-	-	-	-	13.7	23.5	1

Table 10. Continued.

No. of Annuli	Isle			Lac Ste. Anne			Devils		
	Average length, inches	Average weight, ounces	Sample size	Average length, inches	Average weight, ounces	Sample size	Average length, inches	Average weight, ounces	Sample size
Lake Whitefish									
0	Not present			-	-	-			None Collected
1				7.6	3.1	21			
2				10.4	8.5	33			
3				13.2	18.2	9			
4				15.9	31.0	3			
5				17.0	40.6	14			
6				18.0	49.6	14			
7				18.9	55.3	3			
White Suckers									
0	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-
2	9.4	7.5	6	-	-	-	-	-	-
3	11.9	15.9	13	14.4	26.8	9	15.4	35.6	6
4	15.5	33.5	20	15.9	34.7	27	16.4	37.6	18
5	17.1	43.0	55	17.3	43.3	28	17.8	45.4	20
6	19.0	59.2	47	18.8	53.1	12	18.8	53.1	7
7	-	-	-	-	-	-	19.9	61.8	5

Table 11. Length-weight and length-frequency relationships of five species of fish from three lakes on the Sturgeon River, 1969.

Fork Length, Inches	Isle						Lac Ste. Anne						Devils					
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	
11	6.0	5.5	6.5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	8.3	7.5	9.5	3	-	-	-	-	-	-	-	-	9.0	9.0	9.0	1	-	-
13	11.0	9.0	14.0	11	-	-	-	-	-	-	-	-	10.0	10.0	10.0	1	-	-
14	12.8	11.0	14.5	21	12.0	12.0	12.0	1	-	-	-	-	-	-	-	-	-	-
15	17.0	15.0	20.0	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	19.0	17.0	25.0	28	19.2	17.5	20.0	5	-	-	-	-	16.0	16.0	16.0	1	-	-
17	25.0	20.0	44.0	29	23.0	20.5	26.0	13	-	-	-	-	17.7	14.5	20.0	7	-	-
18	30.3	24.5	31.5	17	26.5	23.0	30.0	17	-	-	-	-	22.3	19.0	24.5	6	-	-
19	31.5	27.5	38.5	9	32.5	27.0	39.0	22	-	-	-	-	24.7	20.5	30.0	5	-	-
20	35.7	32.0	50.0	9	34.3	30.0	39.0	15	-	-	-	-	30.0	30.0	30.0	1	-	-
21	40.9	39.5	42.5	5	39.3	34.0	45.0	7	-	-	-	-	35.0	34.0	36.0	2	-	-
22	44.7	38.0	52.0	9	44.3	37.0	51.0	8	-	-	-	-	-	-	-	-	-	-
23	55.7	55.0	56.5	2	51.0	45.0	59.0	2	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	57.5	57.5	57.5	1	-	-	-	-	-	-	-	-	-
25	70.0	70.0	70.0	1	60.0	60.0	60.0	1	-	-	-	-	-	-	-	-	-	-
26	68.5	65.0	72.0	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													-	-	-	-	-	-
													254.0	254.0	254.0	1	-	-

Table 11. Continued.

Fork Length, Inches	Isle						Weight, Ounces					
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.
Walleye												
3	-	-	-	-	-	-	-	-	0.3	0.2	0.3	2
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	1.3	1.3	1.3	1
6	1.7	1.5	2.0	4	2.0	2.0	2.0	1	1.6	1.5	1.6	2
7	2.5	2.0	2.7	12	2.5	2.0	2.7	2	-	-	-	-
8	3.5	2.3	4.3	47	3.5	3.4	3.7	2	-	-	-	-
9	4.9	4.0	5.7	33	5.5	4.0	8.5	12	-	-	-	-
10	6.4	5.5	7.0	11	6.9	5.7	8.0	20	-	-	-	-
11	-	-	-	-	8.7	7.3	10.5	10	-	-	-	-
12	-	-	-	-	11.7	10.5	13.5	16	-	-	-	-
13	15.5	13.0	18.6	3	14.3	12.0	17.0	15	-	-	-	-
14	-	-	-	-	19.3	17.5	22.0	6	-	-	-	-
15	23.3	21.0	24.5	3	20.5	20.5	20.5	2	24.5	24.5	24.5	1
16	30.3	26.5	32.5	3	28.0	25.0	35.5	11	28.5	24.5	32.5	2
17	38.0	30.5	45.0	11	37.3	32.0	43.5	17	37.7	34.5	42.0	4
18	41.6	30.5	50.0	8	43.3	37.0	49.5	22	43.7	41.0	48.0	8
19	50.5	42.0	56.5	11	50.0	43.0	54.0	9	49.0	33.0	55.0	7
20	58.0	47.5	68.5	15	58.3	55.0	67.0	4	52.5	49.5	60.5	7

Table 11. Continued.

Fork Length, Inches	Weight, Ounces										
	Isle			Lac Ste. Anne			Devils				
Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.
Walleye (cont'd)											
21	69.5	58.0	75.0	7	62.0	62.0	1	56.0	52.0	66.5	4
22	69.0	58.0	80.0	2	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-
25	104.0	104.0	104.0	1	-	-	-	-	-	-	-
Perch											
3	0.3	0.3	0.3	1	-	-	-	-	-	-	-
4	1.0	1.0	1.0	2	-	-	-	-	-	-	-
5	1.2	1.0	1.5	46	1.3	1.0	1.7	36	1.5	1.0	1.7
6	2.0	1.5	3.0	18	2.0	1.5	2.5	18	2.2	1.7	2.7
7	3.2	2.5	4.3	24	3.3	2.7	3.7	13	3.3	3.0	3.3
8	4.1	2.7	5.0	5	4.1	3.7	4.5	3	-	-	-
9	6.7	6.5	7.0	2	5.7	5.7	5.7	1	9.0	9.0	1
10	9.8	9.5	10.0	3	10.5	9.0	12.0	5	-	-	-
11	-	-	-	-	9.9	9.0	11.0	3	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	23.5	23.5	23.5

Table 11. Continued.

Fork Length, Inches	Weight, Ounces							
	Isle			Lac Ste. Anne				
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.
Lake Whitefish								
6					2.5	2.5	2.5	1
7					2.9	2.6	3.5	14
8					3.6	3.3	4.0	6
9					7.3	7.0	8.3	4
	Not present				8.3	6.6	10.0	23
10					10.5	10.0	11.0	6
11					15.3	14.0	16.0	3
12					16.5	15.0	18.5	3
13					22.5	22.0	23.5	3
14					30.7	30.0	31.5	2
15					43.0	32.0	58.0	9
16					48.0	41.5	52.0	10
17					48.7	42.5	56.0	10
18					57.5	57.0	58.0	2
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Table 11. Continued.

Fork Length, Inches	Weight, Ounces											
	Isle				Lac Ste. Anne				Devils			
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.
White Suckers												
8	6.7	6.7	6.7	1	-	-	-	-	-	-	-	-
9	12.5	5.3	21.0	5	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	13.7	11.0	16.0	8	-	-	-	-	-	-	-	-
12	18.5	13.0	32.0	10	-	-	-	-	-	-	-	-
13	21.3	20.0	24.0	3	23.3	23.0	23.5	2	-	-	-	-
14	-	-	-	-	27.0	24.0	30.0	4	25.5	20.9	27.9	2
15	33.5	26.0	51.5	22	32.7	26.0	40.0	34	31.5	29.5	37.5	10
16	36.7	26.0	43.0	46	36.5	30.5	43.0	55	37.3	29.0	42.5	24
17	44.3	38.0	56.5	26	45.0	36.5	55.0	22	46.0	32.5	54.5	15
18	53.7	44.0	60.5	34	48.7	45.0	52.0	10	51.5	28.0	60.0	18
19	62.3	50.0	69.0	42	56.3	53.0	60.0	3	56.0	50.5	64.0	7
20	69.7	60.0	84.0	9	-	-	-	-	63.7	60.5	65.0	4
21	69.0	69.0	69.0	1	-	-	-	-	-	-	-	-

Table 12. Percentage volumes of food organisms of five species of fish from three lakes on the Sturgeon River, 1969.

Species	Spottail Shiner	Perch	Walleye	Unidentified fish	Chironomids	Amphipods	Chaoborus	Gastropods	Sphaeriids	Leech	Percentage stomachs con- taining food	Number examined
Isle Lake												
Pike	36.8	33.9	-	21.1	5.3	2.6	-	-	-	0.3	37.2	102
Perch	-	-	-	1.4	87.2	11.4	-	-	-	-	56.5	62
Walleye	2.3	8.5	-	28.2	13.9	8.7	38.4	-	-	-	64.9	134
Burbot	-	-	-	-	-	-	-	-	-	-	0.0	1
Lac Ste. Anne												
Pike	-	51.4	-	40.1	-	8.5	-	-	-	-	58.5	91
Perch	-	3.6	-	13.4	15.9	35.0	-	16.6	4.8	7.1	45.2	62
Walleye	20.5	54.4	-	20.4	0.9	1.9	-	-	-	-	72.1	147
Lake Whitefish	-	-	-	-	14.0	73.4	-	4.3	7.8	0.5	53.5	86
Burbot	-	-	-	-	100.0	-	-	-	-	-	100.0	1
Devils Lake												
Pike	46.4	25.0	14.3	14.3	-	-	-	-	-	-	56.0	25
Perch	-	-	-	-	43.3	53.3	3.4	-	-	-	53.6	28
Walleye	24.8	33.7	-	26.9	14.6	-	-	-	-	-	65.9	41
Burbot	-	-	-	-	100.0	-	-	-	-	-	66.7	3

each comprising about 23 percent of the catch. Quantitatively white suckers dominated the catch contributing 55.3 percent of the total weight.

Approximately 60 percent of the pike taken were two years of age. Only three pike over four years of age were caught. The age structure of the walleye sample also indicates the existence of a large number of age two individuals. The irregularities of the age-frequency pattern of walleye suggests that spawning failures have periodically occurred. The relative abundance of perch appears to be "typical" having many more younger than older fish. White suckers were equally numerous over a wide range of ages. Growth of all species sampled is reasonable for lakes in this portion of Alberta.

The diet of the pike sampled was primarily fish. Only eight percent of the stomach contents observed consisted of bottom fauna. Walleye were much more omnivorous than the pike. Approximately 60 percent of their food items were various types of benthos. Perch fed almost exclusively upon chironomids and amphipods.

Lac Ste. Anne

The average catch per lift was 93.3 fish weighing 158.6 pounds. The relative abundance of all species collected was reasonably consistent. White suckers and walleye were equally dominant each comprising 25 percent of the catch.

Table 13 shows the test netting data separated into results from the east and west bays. It appears that the populations inhabiting the two bays differ in qualitative composition. Relative

Table 13. Comparison of test catches of fish from the east and west bays of Lac Ste. Anne, 1969.

Date	Depth, ft.	Average number per net lift							Total
		Pike	Perch	Walleye	White Sucker	Lake Whitefish	Burbot		
East Bay									
July 11	15.5	12	-	29	31	30	-	102	
July 16	10.0	13	5	44	7	33	-	102	
August 13	23.0	6	12	25	31	29	-	103	
August 14	9.0	31	51	20	24	3	-	129	
Total	-	62	97	89	93	95	-	436	
Average	14.4	15.5	24.3	22.3	23.2	23.7	-	109.0	
West Bay									
July 15	24.0	18	6	18	19	3	1	65	
August 26	10.0	15	5	13	26	1	-	60	
Total	-	33	11	31	45	4	1	125	
Average	17.0	16.5	5.5	15.5	22.5	2.0	0.5	62.5	

abundance of pike and white suckers was very similar. The east bay produced four times more perch, twelve times more lake whitefish, and 30 percent more walleye than the average test effort in the west bay. The average total number of fish caught per net lift in the east bay was 43 percent greater than the catch from the west bay.

Approximately 86 percent of the pike sampled were in the two, three and four year age groups. The largest pike captured was seven years of age. The age-frequency pattern for walleye indicates the presence of many young individuals and the irregularities of the pattern indicate the occurrence of past spawning failures. The structure of the perch population appears to be "typical", similar to that in Lake Isle. The irregular age structure of the whitefish sample suggests that the population of this species has also been subjected to periodic spawning failures. The presence of a large number of young whitefish suggests that current recruitment to the population is adequate. White suckers were abundant in nearly all the age groups represented in the sample. The growth rates of both walleye and perch appear to be lower in Lac Ste. Anne than in either Lake Isle or Devils Lake.

The stomach contents from pike consisted of over 90 percent fish, most of which was perch. The diet of perch was very cosmopolitan. However, amphipods were the most frequently observed food item. Walleye fed almost exclusively upon fish. Perch was the most abundant species of forage fish noted. Lake whitefish fed entirely upon bottom fauna. Over 70 percent of their stomach contents were amphipods.

Devils Lake

The fish population of Devils Lake appears to be considerably less dense than those of both Lake Isle and Lac Ste. Anne. The test netting produced an average catch of only 50.5 fish weighing 96.1 pounds. White suckers made up nearly 40 percent of the total number of fish collected and 57 percent of the total weight. Pike and walleye contributed 12.6 and 20.9 percent of the catch, respectively. The relative number of perch caught in Devils Lake (24.9%) was significantly greater than the catch of this species either in Lac Ste. Anne or Lake Isle.

Eighteen of the twenty pike captured were two years of age. There was a conspicuous absence of pike over the age of two. All the age groups of the walleye sample, except the age eight group, were small. It appears that the last strong age class was produced in 1961. Two age classes (3 and 4) were completely absent suggesting the occurrence of past spawning failures. The perch population appears to be thriving well. Whitefish are reported to inhabit the lake but none were taken during the survey. As usual several age classes of white suckers were well represented. The growth rates of all species were ordinary. The largest pike caught was 38.9 inches long and weighed 15.9 pounds.

Pike were entirely piscivorous. Perch fed exclusively upon bottom fauna, primarily amphipods and chironomids. Walleye fed primarily upon fish. The main forage species were perch and spottail shiners. About 15 percent of the stomach contents of walleye were chironomids.

Net Fishing

Commercial

Isle Lake has not been commercially fished since 1948. Divisional records show that Devils Lake has never been netted commercially. Lac Ste. Anne supports an annual fishery that yields about 15,000 to 20,000 pounds of lake whitefish, 2,000 to 4,000 pounds of walleye, and approximately 1,500 pounds of pike. Commercial production statistics are listed in Appendix Table 4 and summarized in Table 14. The legal mesh size has always been 5½-inch stretch mesh. Allowable net yardage per licence is 400.

The fishery on Lac Ste. Anne has deteriorated in the last ten years. The average harvest of whitefish per licence for 1950-1959 was 411 pounds. The comparable calculation for the period 1965 to 1970 is 238 pounds. The current catch of walleye is purposely restricted to a maximum of 4,000 pounds in deference to preservation of the sport fishery. Some of the catches of walleye in the past have been quite substantial. The deterioration of the fishery is also reflected in the reduction in pounds of fish produced per acre. The mean yield per acre prior to 1960 approximated 6.0 pounds. The present production is slightly over one pound per acre.

Domestic

Both Lac Ste. Anne and Devils Lake are subjected to lightly controlled net fishing by Indians and Metis (Table 15). No records of domestic production are available. Isle Lake is free of domestic fishing. The holder of a domestic licence is entitled to fish with one hundred

Table 14. Commercial production of fish on Lac Ste. Anne, 1942-1970.

Seasons	Average No. of Licenses	Average Pounds Per Acre					Total
		Lake Whitefish	Walleye	Perch	Pike		
42/43-46/47	99	5.1	0.1	0.0	0.1	5.3	
47/48-51/52	80	3.1	0.3	0.0	0.1	3.5	
52/53-56/57	331	11.0	0.1	0.0	0.1	11.2	
57/58-61/62	311	5.5	0.3	0.0	0.2	6.0	
62/63-66/67	85	1.2	0.7	0.0	0.1	2.0	
67/68-69/70	50	1.4	0.1	0.0	0.1	1.6	

Table 15. Numbers of Indian Domestic net fishing licenses issued on Lac Ste. Anne and Devils Lake from 1959-1970.

Season	Lac Ste. Anne	Devils
1959-60	56	6
1960-61	55	11
1961-62	na	na
1962-63	34	17
1963-64	na	na
1964-65	na	na
1965-66	43	15
1966-67	50	6
1967-68	2	9
1968-69	28	5
1969-70	63	8
Average for years having statistics	47	6

na = not available

yards of 5½-inch mesh and have one hundred pounds of fish in his possession. During the last ten years there has been an average of 47 licenses issued on Lac Ste. Anne and 6 licenses on Devils Lake.

Assuming each licensee harvests 75 pounds of fish per month, an annual estimate of 42,300 pounds is obtained for Lac Ste. Anne and 5,400 pounds for Devils Lake. The majority of fish netted in Lac Ste. Anne would be lake whitefish. Because whitefish are no longer a major species in Devils Lake the bulk of the domestic harvest here would be pike and walleye.

Sport Fishing

A creel survey including Isle, Lac Ste. Anne and Devils Lakes was carried out during the summer of 1969 as part of the Fish and Wildlife Division's contribution to the Sturgeon River Basin Development Study¹. Clerks interviewed anglers as they completed fishing trips. Aerial counts of boats and shore anglers were obtained on a weekly basis. The survey results are summarized in Table 16.

Lake Isle

An estimated 6,851 anglers spent 21,237 hours fishing from May-October, 1969. About 75 percent of the fishermen were successful in catching at least one fish per trip. Northern pike dominated the

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Lane, C. B. and G. M. Lynch. 1969. A survey of the fishery and wildlife resources of the Sturgeon River Basin. Manus. Rept. Alta. Div. Fish Wildl. 133 pp.

Table 16. Summary of creel surveys on three lakes on the Sturgeon River, May-October, 1969.¹

Estimated Results	Species	Isle	Lac Ste. Anne	Devils
Number of fishermen		6,851	10,674	1,595
Hour spent fishing		21,237	34,317	3,669
Percentage of anglers catching at least one fish	Pike	63.9	52.6	27.9
	Perch	neg.	neg.	8.5
	Walleye	11.3	14.6	0.2
	Total	75.2	67.2	36.6
Catch per angler-hour	Pike	0.76	0.34	0.18
	Perch	neg.	neg.	0.04
	Walleye	0.06	0.12	0.01
	Total	0.82	0.46	0.23
Number of fish (percentage of catch)	Pike	13,337 (92)	13,295 (76)	635 (72)
	Perch	neg.	neg.	158 (18)
	Walleye	1,030 (7)	4,275 (24)	92 (10)
	Total	14,367	17,570	885
Poundage of fish (pounds per acre)	Pike	30,675 (5.4)	31,908 (2.3)	3,239 (16.6)
	Perch	neg.	neg.	126 (0.7)
	Walleye	3,090 (0.5)	9,405 (0.7)	248 (1.3)
	Total	33,765 (5.9)	41,313 (3.0)	3,613 (18.6)

¹ Lane, C. B. and G. M. Lynch. 1969. A survey of the fishery and wildlife resources of the Sturgeon River Basin. Manus. Rept. Alta. Div. Fish Wildl. 133 pp.

harvest constituting 92 percent of the total estimate. The angler production approximated 14,400 fish weighing about 33,800 pounds. The contribution of perch to the sport fishery was negligible. The total catch per angler-hour was 0.82 fish which was the highest rate of success observed during the survey. It should be reasonable to assume that an additional amount of fish are harvested during that portion of the year not included in the survey. This harvest would add about 25 percent or 8,500 pounds to the creel survey total.

Lac Ste. Anne

Pike and walleye contributed 76 and 24 percent, respectively of an estimated angling harvest of 17,570 fish that weighted 41,313 pounds. Lake whitefish, at present, are not regularly caught by anglers. The total catch per angler-hour was 0.46 fish. An estimated 10,674 anglers spent 34,317 hours fishing during the five month survey. Sixty-seven percent of the fishermen caught at least one fish per trip. An additional amount of fish, roughly 25 percent or 10,300 pounds, are taken by anglers during the seven months not included in the creel survey.

Devils Lake

The sport fishery on Devils Lake is supported mainly by pike (72%). However, perch and walleye contributed 18 and 10 percent of the yield, respectively. During the summer of 1969 an estimated 885 fish weighing 3,613 pounds were caught. Production was calculated to be 18.6 pounds per acre. Angling during those months excluded from the survey probably increased the sport harvest by at least 25 percent or

900 pounds. Angling success was considerably less than that recorded for Lac Ste. Anne and Lake Isle. Only 36.6 percent of the anglers interviewed caught at least one fish per trip. The catch per angler-hour was only 0.23 fish. Approximately 1,600 anglers fished the lake for about 3,700 hours during the five month survey period.

Discussion

Each of the three lakes included in this survey has suffered some degree of degradation from the deterioration of the Sturgeon River System. River flows are no longer stable and predictable. Poor land use practices have allowed pollution of the lake system with silt, organic material, and other undesirable substances. The construction of the proposed diversion of water from the Pembina River into the Sturgeon River System should significantly stabilize stream flow conditions particularly during the spring and fall when fish are spawning. Control structures on the lake outlets could also increase the stability of water levels.

Lake Isle

At present, angling is the only utilization of the fishery resource. Commercial netting occurred in the past, but not since 1948. Sampling of fish indicated the presence of thriving populations of pike, perch and walleye. Fish of "trophy" size are, if present at all, few in number.

The creel census indicated that pike dominate the angling harvest even though test netting suggested that both walleye and pike

were present in relatively equal numbers. Angling success for pike was fairly consistent throughout the survey while the successful walleye fishing occurred primarily during the spring and the fall. Shore fishermen caught pike almost exclusively. Because of the dense weed beds surrounding the shoreline, successful walleye anglers had to fish from boats.

The age-frequency pattern for walleye indicates poor population recruitment for age groups three and four (Table 10). Apparently that spawning success for 1965 and 1966 was poor. Recruitment from age class two should be sufficient to sustain the fishery for several seasons even if subsequent spawning failures occurs.

Lac Ste. Anne

Lac Ste. Anne is currently supporting thriving commercial, domestic and sport fisheries. The total yield of fish from the lake, each year approximates 125,000 pounds. About 50 percent of the annual harvest consists of lake whitefish, 40 percent pike and 10 percent walleye. Sport fishing accounts for about 50 percent of the total harvest if the estimated contribution made by domestic net fishermen is considered. If the domestic yield is not considered then anglers are responsible for approximately 75 percent of the total annual harvest. The estimated total minimum annual production of fish is eight pounds per acre.

The lake has been subjected to numerous erratic and significant water level fluctuations during the past 20 years (Table 2).

Table 10 indicates that lake whitefish were poorly represented by age groups three and four. Fish of these ages should have been spawned in 1966 and 1965, respectively. The water level records show reductions in lake depth of 1.9 feet in 1965 and 1.6 feet in 1966. Because lake whitefish spawn in shallow water during the fall, low water levels at this time can result in the destruction of eggs by freezing and/or wind action. It appears that reproductive failures of whitefish do occur in Lac Ste. Anne and that the incidence of the failures is correlated with reductions in water levels. The age class analysis also indicates that recent spawning attempts by whitefish have been successful. A relationship similar to the above has been observed for walleye.

There are significant differences in the biological components of the east and west portions of the lake. The smaller west portion appears to produce larger standing crops of algae than the east bay. The dominant bottom organism from the west bay was the chironomid larvae. Amphipods dominated the samples from the east bay. Both high production of algae and predominance of chironomid larvae are accepted indicators of advancing eutrophication. Nutrients from the surrounding watershed likely enter the west bay via the Sturgeon River. Unfortunately a comparison of the water chemistry of the two bays was not obtained. Test netting indicated that there was a greater abundance of lake whitefish, walleye and perch inhabiting the east bay than the west bay. Perhaps these species prefer the east bay because it is less eutrophic and constitutes more favorable habitat.

Devils Lake

Chemically, Devils Lake is considerably more eutrophic than either Lac Ste. Anne or Lake Isle (Table 4). This characteristic is manifested by the presence of a persistantly dense standing crop of blue-green algae (Tables 5 and 6). Volumes of plankton samples from Devils Lake were many times greater than equivalent samples from the upstream lakes.

Devils Lake is currently being harvested at a relatively high intensity. Anglers are taking about 4,500 pounds of pike, perch and walleye each year (Table 16) and domestic fishermen remove about 5,000 pounds of mainly pike and walleye. It is very doubtful that very many lake whitefish are taken. The calculated yield is 41 pounds per acre.

Test netting indicates that relative abundance of fish is lower than expected when compared with similar data from Lac Ste. Anne and Lake Isle (Table 9). It appears that pike and walleye populations have experienced frequent severe spawning failures (Table 10). The lake whitefish population is now virtually extinct. Because this species spawns in the fall, when water levels are lowest, developing eggs are exposed to a high risk of destruction from freezing and/or mechanical destruction from wind action.

Management Considerations

Water Levels

The quality of the fisheries in all three lakes would

probably be improved or at least preserved by increasing and then maintaining water levels. Shunting in water from the Pembina River and construction of outlet control structures should allow some relief from chronic fluctuations and perhaps some permanent increase in lake levels. Practically speaking, the maximum available increase in lake levels should be sought. The water control program should take into consideration that Lac Ste. Anne requires the maximum water level obtainable in the fall because it supports a valuable population of lake whitefish. Because there are no important fall spawning species inhabiting Lake Isle or Devils Lake the usual pattern of increasing water storage to a maximum in the spring followed by a gradual drawdown the rest of the year should be acceptable. Eggs deposited by walleye, pike and perch, in the spring, should hatch before water levels decrease enough to dry up spawning areas. Construction of water control structures should allow for passage of fish.

Land and Water Use

Little control has been exercised over land use practices within the Sturgeon River Basin. The consequent misuse of the watershed has contributed significantly to the present deteriorated condition of the river and lake system. The most obvious factors contributing to fish habitat deterioration are: (1) the clearing of land up to and into the river, (2) the destruction of stream bank stability, (3) the location of livestock pens next to or in the river, and (4) contamination of the river with domestic, agricultural

(fertilizers) and industrial wastes. Sewage tanks of many of the cottages surrounding the lakes probably leak nutrients into the water. Excessive growth of aquatic vegetation, particularly in the vicinity of cottage developments, is evidence that such organic pollution is occurring.

In order to upgrade or even sustain present environmental quality the current abuse of the watershed must cease. Abusers of proper land use methods must be educated as to the importance of applying beneficial techniques. Livestock excrement, sewage loads and industrial wastes must be disposed of elsewhere. Remedial steps should be taken to stop land erosion and siltation. The fact that much of the land along the Sturgeon River and the three lakes is private makes watershed rehabilitation more difficult. Other government agencies should be encouraged to assist in ensuring that proper use is made of the basin. When required, legal action should be taken against violators of existing protective legislation. The implementation of the Sturgeon River Basin Development proposals should assist in alleviating some of the present problems.

Control of Aquatic Vegetation

During the past few years the demand for permits to use aquatic herbicides has increased substantially. The reasons for the increased demand are readily apparent. Extensive beds of dense vegetation occupy much of the shoreline of each lake, interfering with swimming, boating and angling. The herbicide "Reglone A" (diquat) has been successfully utilized to control plant growth along small sections

of beach¹. There is a risk that excessive use of herbicides can eliminate too much fish habitat and cause the deterioration of the fishery. Until our Division determines what is the maximum amount of vegetation that can be removed without damaging the fishery the use of herbicides must be quite restrictive. A maximum removal of ten percent of the total amount of vegetation appears reasonable at this time.

Domestic Net Fishing

Indians and Metis are presently allowed very liberal netting privileges on Lac Ste. Anne and Devils Lake. No records of yield are kept. In the author's opinion the combined domestic harvest on these lakes is significant, approximating 50,000 pounds. As the demands upon the fisheries increase it becomes more and more important that the removal of fish by domestic netting be accounted for. The problem is more serious on Devils Lake, where roughly 5,000 pounds of walleye and pike are removed annually from sparse populations that can ill afford excessive exploitation.

Creel Census

The Sturgeon River Lakes are situated in a prime recreational location within 50 miles of the rapidly expanding city of Edmonton. The impact of the rising angling pressure upon the sport fish popula-

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Lane, C. B. 1970. Observations on the use of aquatic herbicides on four lakes in the Edson Region, 1970. Memorandum to Division of Fish and Wildlife.

tions should be evaluated at least once every five years. Two prime factors should be determined: (1) total number and weight of each species harvested, and (2) the number of anglers and time spent fishing. The only method available to obtain such information is the creel census.

Summary

Lake Isle

1. A limnological survey was carried out from June to September, 1969.
2. Lake Isle has an area of 9.1 square miles or 5,800 acres. The maximum recorded depth is 31.0 feet. The mean depth is 14.1 feet.
3. Since 1960 there has been a cumulative reduction in water level approximating 1.4 feet.
4. The lake does not thermally stratify during the summer. Dissolved oxygen concentrations were never critically low near the bottom. The most unique chemical characteristic observed was a total phosphate concentration of 0.17 ppm.
5. The standing crop of plankton was dominated by blue-green algae. Heavy "blooms" were observed from June through late August.
6. The observed standing crop of bottom fauna was 48.5 pounds

per acre dry weight. This amount is sufficient to classify the lake as eutrophic. Over 50 percent of the organisms collected were chironomid larvae.

7. Test netting produced an average catch per lift of 139.0 fish weighing 205.6 pounds. Forty-one percent of the fish were white suckers. Walleye and pike were equally represented, each constituting about 23 percent of the catch.

8. No large pike were captured. Only three pike over four years of age were caught. Irregularities in the age structure of the sample of walleye suggest the occurrence of past spawning failures. Poor year class representation of walleye can be correlated with changes in water levels.

9. Isle Lake is not fished with nets.

10. An estimated 6,800 anglers spent 21,000 hours fishing during the survey period. About 75 percent of the fishermen caught at least one fish per trip. Northern pike dominated the yield. The survey yield approximated 34,000 pounds. The total annual was estimated to be 42,000 pounds or 7.2 pounds per acre.

Lac Ste. Anne

1. A limnological survey was carried out from June to September, 1969.

2. The total area of the lake is 22 square miles. The east bay of the lake constitutes 17 square miles. The maximum recorded depth is 32.0 feet and the average depth of the entire lake is 16.1 feet.
3. Lac Ste. Anne has been subjected to numerous water level fluctuations during the past twenty years.
4. Neither portion of the lake exhibited thermal stratification. Minimum levels of dissolved oxygen were never critically low.
5. Algal "blooms" were more prevalent and intense in the west bay of the lake. Volumes of plankton samples from this location were always larger than those from the east bay. The "blooms" were caused by the blue-green algae Anabaena and Microcystis.
6. The estimated standing crop of bottom fauna was 64.8 pounds per acre, more than enough to classify it as eutrophic. The east bay appeared more productive than the west bay. Collections from the east bay were dominated by amphipods while samples from the west bay consisted mainly of chironomids.
7. The average catch per lift was 93.3 fish weighing 158.6 pounds. White suckers and walleye dominated the catch. The east bay produced four times more perch, twelve times more

lake whitefish and thirty percent more walleye than the west bay.

8. Very few pike over age five were collected. Irregularities in the age structures of both walleye and lake whitefish indicate that past spawning failures have occurred. These age gaps can be directly correlated to changes in water levels.

9. Commercial fishermen currently take approximately 15,000 pounds of whitefish 2,000 pounds of walleye and 1,000 pounds of pike annually. Netting success has declined over the past twenty years. An average of 47 domestic licenses are issued each year. No records of the domestic harvest are kept. It is estimated that at least 40,000 pounds of fish are taken each year with domestic nets.

10. The estimated summer angling yield is 17,570 fish weighing 41,313 pounds. The catch is dominated by pike but walleye contribute 24 percent of the total. Lake whitefish, at present, are not regularly caught by anglers. An estimated 10,674 anglers spent 34,317 hours fishing during the survey.

11. Including net fishing the minimum annual production of fish is estimated to be 8.0 pounds per acre.

Devils Lake

1. The lake was surveyed from May to September, 1969.

2. Surface area of the lake is 198 acres. Maximum recorded depth is 35 feet and the calculated mean depth is 18 acres.

3. Although no water level data for Devils Lake are available observations indicate a drop of two to three feet has occurred.

4. The lake did not exhibit strong thermal stratification. Dissolved oxygen concentrations in water deeper than 25 feet were below lethal levels for fish. Light penetration was poor because of the presence of dense algal "blooms". The laboratory chemical analysis indicated that Devils Lake is much more eutrophic than the two upstream lakes.

5. Algal production in Devils Lake for exceeds that observed in either Lac Ste. Anne or Lake Isle. The average sample volume was 9.9 milliliters. The population of zooplankton was very scarce.

6. Standing crop of benthic organisms was calculated to be 48.9 pounds per acre. Amphipods made up 66.4 percent of the organisms collected.

7. The fish populations of the lake appear to be considerably less dense than those of Lake Isle and Lac Ste. Anne. The average catch per lift was only 50.5 fish weighing 96.1 pounds. White suckers made up 40 percent of the total numbers and 57 percent of the total weight. Pike and walleye contrib-

buted 12.6 and 20.9 percent of the catch, respectively.

Perch constituted 24.9 percent of the test catch. Although whitefish are reported to inhabit the lake none were caught.

8. There was a conspicuous absence of pike over age two.

All of the age class representations for walleye, with the exception of age group eight, were small. It appears that the last strong age class of walleye was produced in 1961. Two age classes (3 and 4) were completely absent suggesting the occurrence of past spawning failures.

9. Devils Lake is not commercially fished but is subjected to a lightly controlled program of domestic netting. The author estimates that about 5,000 pounds of pike and walleye are netted each year.

10. The creel survey indicated that the sport fishery is supported mainly by pike. Perch and walleye contributed 18 and 10 percent of the surveyed catch, respectively. Angling success on Devils Lake was considerably less than that recorded for Lac Ste. Anne and Lake Isle. Only 36.6 percent of the anglers interviewed caught at least one fish per trip. The total annual sport fishing yield was calculated to be 4,500 pounds or 23 pounds per acre.

11. The combined annual net and angling harvest of fish from the lake approximates 9,500 pounds or 48 pounds per acre.

General Considerations

1. Unstable water levels have adversely affected the fisheries in all three lakes.
2. Current limnological conditions have allowed dense beds of aquatic vegetation to develop and hinder recreational use of the lake. The demand for permission to apply aquatic herbicides has increased substantially in the past few years. "Reglone A" (diquat) when applied correctly has been successfully utilized on all three lakes.
3. The implementation of the water diversion scheme put forth in "The Sturgeon River Basin Development Study" should provide some alleviation of the problem of inconsistent stream flows and unstable lake levels.

Recommendations

1. The Fish and Wildlife Division be given at least one year's advanced notice of the construction of any phase of the proposed water diversion plan.
2. Water levels of all the lakes be raised as much as possible and fluctuations, particularly in the fall on Lac Ste. Anne, be held to a minimum. Passage of fish through outlet control structures should be facilitated.

3. The highest possible minimum annual flow should be maintained in the Sturgeon River. An eight to ten cubic feet per second flow should be adequate.
4. Records of the total annual yield from domestic fishing should be obtained. Cooperation of Indians and Metis must be obtained.
5. Experiments to determine the maximum amount of aquatic vegetation that can be removed without harming the fishery resource should be initiated.
6. Periodic (at least every five years) creel census information should be collected to help evaluate the existing management program.
7. There should be no changes in the present program of commercial fishing.
8. The land owners along the Sturgeon River and on the lake shores should be educated as to the adverse consequences arising from the improper use of land and water. Remedial actions should be encouraged. Other government agencies should be requested to assist in such a program. When necessary, legal action should be taken to protect the quality of the river system.

Appendix

Appendix Table 1. Physical and chemical observations from three lakes on the Sturgeon River, 1969.

Depth, Feet	Isle Lake					
	June 6	June 25	July 9	July 23	Aug. 6	Aug. 28
Temperature, °C						
Air	22.9	20.1	27.6	25.5	23.3	22.9
Surface	18.4	17.6	18.2	21.4	21.0	18.6
4	18.2	17.5	17.8	19.0	20.9	18.0
6	18.0	-	17.5	18.6	20.6	18.0
11	17.8	-	17.2	-	19.0	17.2
14	17.6	17.4	17.0	18.2	18.6	17.1
18	17.4	17.3	17.0	18.0	18.3	17.0
19	16.8	17.3	-	17.8	-	-
20	15.9	17.3	17.0	-	18.3	-
21	15.8	-	-	17.6	-	-
22	15.4	17.1	16.9	-	18.1	-
23	15.0	-	-	-	-	17.0
25	14.8	17.0	16.8	17.4	18.1	17.0
28 (Bottom)	14.7	17.0	-	-	-	17.0
Dissolved Oxygen, cc/l.						
Surface	4.9	5.5	6.6	8.9	7.3	5.2
14	4.8	-	5.0	-	-	6.5
18	4.4	5.1	-	-	-	-
19	3.5	-	-	-	-	-
20	3.4	-	-	5.8	-	4.3
22	3.0	-	-	-	-	-
23	2.6	-	-	-	-	-

Appendix Table 1 • Continued.

Isle Lake

Depth, Feet	June 6			June 25			July 9			July 23			Aug. 6			Aug. 28		
	pH	Surface	8.4	8.8	9.1	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	9+	
14		8.3	-	-	8.8	-	-	-	-	-	-	-	-	-	-	-	-	
18		8.2	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
19		8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
20		7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
22		7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
23		7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
26		7.7	8.4	-	8.6	-	-	-	-	-	-	-	-	-	-	-	-	
Secchi Disc, ft.		9.5	3.5	2.5	2.5	1.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	

Lac Ste. Anne (2 stations)

Depth, Feet	June 7			June 26			July 9			July 24			Aug. 6			Aug. 26		
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Temperature, °C																		
Air	19.8	22.4	24.2	20.2	27.6	32.4	26.9	22.7	25.1	23.3	26.7	28.5						
Surface	18.3	17.2	17.4	17.5	19.2	19.3	19.4	18.7	19.9	18.7	18.3	19.5						
2	18.3	17.2	-	-	-	18.8	19.2	18.5	19.5	18.3	18.2	18.2						
4	-	17.0	17.4	17.5	18.6	18.4	19.1	18.5	19.2	18.3	18.1	17.8						
8	17.7	16.4	17.0	17.0	18.3	17.8	19.1	-	19.0	18.1	18.0	17.4						
12	17.6	16.2	16.5	-	18.2	17.1	18.9	-	18.7	18.0	17.9	-						
15	17.4	16.1	-	-	18.0	17.0	-	-	-	-	-	-						
18	16.6	-	16.4	16.9	17.5	16.8	18.8	18.2	-	17.6	-	17.1						
20	15.9	16.0	16.4	16.8	17.4	16.8	18.5	-	18.5	17.6	17.8	-						

Appendix Table 1. Continued

Appendix Table 1. Continued.

Lac Ste. Anne (2 stations)

Depth, Feet	Lac Ste. Anne (2 stations)																
	June 7			June 26			July 9			July 24			Aug. 6			Aug. 26	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
pH Surface	8.4	8.3	8.5	8.1	8.8	8.5	8.9	8.6	9.0	8.5	9+	8.5					
4	-	-	-	-	-	-	-	-	-	-	-	-					
10	8.3	-	-	-	-	-	-	-	-	-	-	-					
14	-	8.2	-	-	-	-	-	-	-	-	-	-					
18	7.9	-	-	-	-	-	-	-	-	-	-	-					
20	7.5	8.2	-	-	-	-	-	-	-	-	-	-					
22	-	-	8.3	-	-	-	8.6	-	-	-	-	-					
24	7.4	-	-	-	-	8.6	-	-	-	8.7	-	9+	-				
26	-	8.2	-	-	-	-	-	-	-	-	-	-					
28	-	7.6	-	8.1	-	8.5	-	7.9	-	-	-	-					
30	-	7.5	-	-	-	-	-	-	-	-	8.5	-	8.5	-			
Secchi Disc, ft.	6.5	12.5	4.5	11.0	3.0	9.0	2.5	5.0	2.8	7.5	1.3	5.8					

Devils Lake

Depth, Feet	Devils Lake				
	June 17		July 7		July 21
Temperature, °C	Air	Surface	4	6	
28.1	23.2	21.6	27.5	16.5	
20.2	16.6	17.9	22.0	18.4	
-	16.0	17.8	18.6	18.2	
-	16.0	17.8	18.6	-	
20.1	15.8	17.7	18.5	18.2	
19.4	15.8	17.7	18.5	18.1	

Appendix Table 1. Continued.

Devils Lake

Depth, Feet	June 17	July 7	July 21	Aug. 4	Aug. 28
12	17.2	-	17.7	18.5	-
14	16.5	15.8	17.6	18.4	18.0
16	15.7	15.8	17.6	18.1	-
18	14.9	15.7	17.6	17.7	17.7
20	14.2	15.6	17.6	17.5	17.6
22	13.2	15.2	17.5	17.0	17.5
24	12.4	12.8	17.5	16.6	17.4
26	11.8	12.2	17.5	16.0	17.2
28	11.4	12.0	17.5	16.0	17.2
30	-	-	-	-	17.0
Dissolved Oxygen, cc/l. Surface	10.3	8.0	5.2	12.2	5.9
6	-	-	-	-	-
12	10.2	-	-	-	-
14	-	-	-	-	-
16	8.6	-	5.0	3.0	4.0
18	4.8	-	-	-	-
20	2.8	-	-	-	-
24	-	4.0	-	-	-
26	-	0.3	-	-	-
28	0.5	-	1.3	0.7	2.4
30	-	-	-	-	-

Appendix Table 1. Continued.

		Devils Lake				
		June 17	July 7	July 21	Aug. 4	Aug. 28
Depth, Feet	pH	Surface	9.0	9.2	9.1	9+
6		-	-	-	-	-
12		8.9	-	-	-	-
14		-	-	-	-	-
16		-	-	-	-	-
18		8.8	-	-	-	-
20		8.5	-	-	-	-
24		-	8.8	-	-	-
26		-	7.5	-	-	-
28		7.8	-	8.6	8.2	8.8
30		-	-	-	-	-
Secchi Disc, ft.		3.0	1.8	2.3	2.3	2.9

Appendix Table 2. Bottom fauna samples from three lakes on the Sturgeon River, 1969.

Numbers per six-inch Ekman Dredge

Number	Depth, feet	Bottom Type	Hyalella	Gemmarus	Total Amphipods	Chironomids	Ceratopogonids	Sphaeritids	Gastropods	Leeches	Oligochaetes	Caddis L.	Miscellaneous	Total	Volume, ml's.	Wet weight less shells, gms.	
Isle Lake (47 dredgings)																	
		Series 1, June 6															
1	5	sand	13	8	21	5	-	-	2	1	-	-	-	27	0.4	0.62	
2	21	ooze	-	-	-	38	1	-	-	-	43	2.8	1.51	-	-	1.24	
3	20	ooze	-	-	-	28	-	-	-	-	29	1.5	1.24	-	-	1.54	
4	21	ooze	-	-	-	36	7	-	-	-	43	2.1	2.23	-	-	2.23	
5	29	ooze	-	-	-	61	-	-	-	-	61	3.3	1.94	-	-	1.94	
6	25	ooze	-	-	-	39	3	2	-	-	44	2.6	-	-	-	-	
		Series 2, June 14															
1	9	mud, ooze	-	-	-	12	-	-	4	-	-	-	-	-	1.1	0.70	
2	18	mud, ooze	-	-	-	19	-	-	1	-	-	-	-	23	1.8	1.10	
3	19	mud, ooze	-	-	-	14	1	-	-	-	-	-	-	16	1.2	0.72	
4	20	mud, ooze	-	-	-	20	8	-	-	-	-	-	-	28	1.6	0.88	
5	19	mud, ooze	-	-	-	23	30	-	-	-	-	-	-	55	1.9	1.34	
6	16	mud, ooze	-	-	-	12	-	-	2	-	-	-	-	16	1.2	0.79	
		Series 3, July 28															
1	9	silt, ooze	-	-	-	2	1	-	-	-	-	-	-	1	-	4	
2	10	clay, silt	-	-	-	23	-	-	-	-	-	-	-	3	-	26	
3	11	clay, silt	-	-	-	79	2	-	2	-	1	4	-	-	-	88	
4	11	clay, silt	-	-	-	48	-	-	4	-	-	10	-	-	-	62	
5	14	clay, silt	-	-	-	21	-	-	-	-	-	-	-	7	-	1	
														30	1.4	0.91	

Numbers per six-inch Ekman Dredge

Number	Depth, feet	Bottom Type	Hydilella	Gammareus	Chironomids	Ceratopogonids	Sphaerididae	Gastropods	Leeches	Oligochaetes	Caddis L.	Miscellaneous	Total Volume, ml's.	Wet weight, grams shells, grams
		Series 3, July 28 cont'd.												
6	13	clay, silt ooze	-	-	31	-	7	-	1	-	-	39	1.1	0.60
7	10	clay, silt ooze	-	-	15	-	3	2	-	1	-	-	21	0.7
		Series 4, July 28												
1	8	sandy	6	4	10	43	-	2	-	1	-	-	57	0.8
2	18	silt, ooze	-	-	-	16	-	-	-	3	-	-	19	1.2
3	20	clay, silt	-	-	-	20	-	-	-	8	-	-	29	1.5
4	19	clay, silt	-	-	-	13	-	-	-	4	-	-	18	1.2
5	19	clay, silt	-	-	-	-	-	-	-	-	-	-	12	0.6
6	21	clay, silt ooze	-	-	-	-	-	-	-	-	-	-	13	0.7
		Series 5, August 11												
1	4	black, ooze	47	38	85	10	-	6	8	2	-	-	10	1.0
2	9	black, clay	3	1	4	26	-	1	2	-	-	-	12	1.3
3	12	black, ooze	2	-	-	-	-	-	-	2	-	-	6	0.4
4	16	ooze	1	-	-	-	-	-	-	-	-	-	4	0.7
5	18	black, ooze	-	-	-	-	-	-	-	1	-	-	9	0.7
6	26	black, ooze	-	-	-	-	-	-	-	3	-	-	14	0.6
7	23	black, ooze	-	-	-	-	-	-	-	3	-	-	37	0.6
8	21	black, ooze	-	-	-	-	-	-	-	3	-	-	56	0.2

Appendix Table 2 continued.

Numbers per six-inch Ekman Dredge

Number	Depth, feet	Bottom Type	Hyalinea	Gammarus	Chironomids	Ceratopogonidae	Gastropods	Leeches	Oligochaetes	Caddis L.	Miscellaneous	Total	Volume, ml's.	Wet weight less shells, g.	Wet weight less shells, g.			
															1	2		
9	21	black, ooze	1	2	3	7	-	-	-	-	-	10	0.3	0.16				
10	21	black, ooze	-	-	-	50	1	-	-	-	-	53	1.0	0.48				
11	13	sand, weed	120	260	380	1	-	4	1	-	-	391	6.0	4.61				
12	4	sand, weed	16	7	2,	1	-	6	4	-	-	40	4.0	0.53				
															72			
1	23	-	-	-	-	14	3	-	-	-	-	20	1.9	0.94				
2	23	-	-	-	-	45	48	-	-	-	-	96	3.4	2.55				
1	26	mud	-	-	-	50	10	-	-	-	-	61	2.6	1.99				
2	26	mud	-	-	-	44	18	-	-	-	-	64	2.8	2.10				
1	25	mud, ooze	-	-	-	34	1	-	-	-	-	-	35	2.5	1.92			
2	25	mud, ooze	-	-	-	22	-	-	-	-	-	-	22	1.8	1.02			
1	26	black, ooze	-	-	-	10	-	-	-	-	-	-	10	0.8	0.41			
2	26	black, ooze	-	-	-	14	-	-	-	-	-	-	14	0.8	0.44			
1	26	black, ooze	-	-	-	26	-	-	-	-	-	-	-	29	1.0	0.58		
2	26	black, ooze	-	-	-	14	-	-	-	-	-	-	-	14	0.3	0.12		
Total	209	321	530	1,122	200	30	44	15	14	102	-	1	2,058	74.3	45.68			
Average	4.5	6.8	11.3	23.9	4.3	0.6	0.9	0.3	0.3	2.2	-	-	43.8	1.58	0.972			

Appendix Table 2 continued.

Numbers per six-inch Ekman Dredge

Number	Depth, feet	Bottom Type	Lac Ste. Anne, West Bay (26 dredgings)										Wet weight less shells, grams	Wet weight less frames	
			Gemmatus	Chironomids	Ceratopogons	Sphaeritids	Gastropods	Leeches	Oligochaetes	Gobids L.	Miscellaneous	Total			
Series 1, June 7															
1	7	sand, ooze	-	-	81	-	3	5	-	-	-	90	6.3	4.23	
2	14	mud, ooze	-	-	14	-	1	1	-	-	-	14	0.9	0.50	
3	19	mud, ooze	-	-	12	5	-	-	-	-	-	18	0.7	0.35	
4	31	mud, ooze	-	-	7	9	2	-	-	-	-	18	1.0	0.56	
5	22	plant debris, ooze	-	-	68	32	12	-	-	-	-	113	4.1	2.97	
6	21	mud, ooze	-	-	46	23	3	-	-	-	-	72	2.4	1.80	
Series 3, August 6															
1	18	sand, ooze	-	-	2	-	2	11	-	-	-	-	21	2.2	0.31
2	16	clay, ooze	-	-	38	-	2	5	-	-	-	-	50	2.6	2.10
3	22	clay, ooze	-	-	3	-	1	-	-	-	-	-	3	0.2	0.13
4	21	clay, ooze	-	-	23	-	3	-	-	-	-	-	28	2.3	1.41
5	15	clay, silt	-	-	32	-	5	-	-	-	-	-	38	2.0	1.16
6	20	clay, ooze	-	-	49	-	2	4	-	-	-	-	64	3.9	2.51
Limnology Station I, June 7															
1	24	-	-	-	-	-	13	2	1	-	-	-	23	1.2	0.92
2	24	-	-	-	-	-	10	12	-	-	-	-	25	1.0	0.39
June 28															
1	24	mud, ooze	-	-	-	-	-	-	-	-	-	-	23	0.80	0.09
2	24	mud, ooze	-	-	-	-	-	-	-	-	-	-	3	0.2	0.00

Appendix Table 2 continued.

Limnology Station I cont'd.

Number	Depth, feet	Bottom Type	Hab. L.	Gammareus		Ceratopogonids	Sphaeridae	Gastropods	Leeches	Oligochaetes	Caddis L.	Miscellaneous	Volume, ml's.	Wet weight less shells, grams		
				Total Amphipods	Chironomids											
Limnology Station I cont'd.																
July 9																
1 24	mud, ooze	-	-	-	11	-	-	-	-	-	-	11	0.6	0.35		
2 24	mud, ooze	-	-	-	15	1	-	-	-	-	-	16	1.1	0.66		
July 24																
1 24	black, ooze	-	-	-	3	-	-	2	-	-	-	5	0.15	0.11		
2 24	black, ooze	-	-	-	1	-	-	2	-	-	-	3	0.2	0.06		
August 6																
1 24	clay, silt	-	-	-	8	-	-	1	2	-	-	11	0.6	0.25		
2 24	clay, silt	-	-	-	8	-	-	-	-	-	-	8	0.9	0.44		
August 26																
1 24	clay, ooze	1	-	-	1	7	4	1	-	3	-	-	16	0.5	0.49	
2 24	clay, ooze	-	-	-	-	27	4	-	3	-	4	-	38	0.7	0.51	
August 28																
1 26	clay, ooze	1	-	-	1	23	18	-	-	-	2	-	44	1.1	1.26	
2 26	clay, ooze	-	-	-	-	38	31	-	-	-	4	-	73	1.9	2.17	
Total					2	565	148	30	36	-	3	45	-	1	830	39.65
Average					0.1	21.7	5.7	1.2	1.4	-	0.1	1.7	-	0.04	31.9	1.53
															1.049	

Appendix Table 2 continued.

Number	Depth, feet	Bottom Type	Lac Ste. Anne, East Bay (50 dredgings)																			
			Series 2, June 27				August 6				Series 4, August 6				1	2	3	4	5	6	7	
			1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7
Gammarus			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hyalaea			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Amphipods			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chironomids			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ceratopogonids			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sphaeridiids			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Gastropods			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Leeches			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Oligochaetes			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caddis L.			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Miscellaneouss			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total			-	-	-	-	-	-	-	55	10	0.77	0.41	0.22	75	24	0.6	0.41	0.22	0.19	0.05	
Volume, MLS.			-	-	-	-	-	-	-	24	0.6	0.41	0.22	0.19	0.05	18	0.7	0.35	0.16	0.03	0.11	
Wet weight, gms			-	-	-	-	-	-	-	18	0.6	0.41	0.22	0.19	0.05	14	0.2	0.1	0.1	0.03	0.11	

Appendix Table 2 continued.

Appendix Table 2 continued.

Appendix Table 2 continued.

Numbers per six-inch Ekman Dredge

Number	Depth, feet	Bottom Type	Hyalinea	Gemmatus	Total Amphipods	Chironomids	Ceratopogonidae	Gastropods	Leeches	Oligochaetes	Caddis L.	Miscellaneous	Total	Volume, mls.	Wet weight less shells, grams		
Limnology Station III, Cont'd.																	
Total	785	740	1,525	1,079	3	6	110	109	72	117	5	10	3,036	95.0	74.91		
Average	15.7	14.8	30.5	21.6	0.06	0.1	2.2	2.2	1.4	2.3	0.1	0.2	60.7	1.9	1.498		
Lac Ste. Anne, Total Lake (76 dredgings)																	
Total	787	740	1,527	1,644	151	36	146	109	75	162	5	11	3,866	134.65	102.20		
Average	10.4	9.7	20.1	21.6	2.0	0.5	1.9	1.4	1.0	2.1	0.1	0.1	50.9	1.8	1.3		
Devils Lake (40 dredgings)																	
Series 1, July 7																	
1	51	sand, mud weeds	-	-	3	3	1	1	-	-	-	-	1	6	0.2	0.04	
2	30	mud	-	-	7	7	-	4	-	-	7	-	-	18	0.4	0.15	
3	29	sand	1	5	6	-	-	7	-	-	23	-	-	36	0.5	0.32	
4	9	sand, mud	6	-	6	24	-	-	1	-	-	-	-	31	1.1	0.66	
Series 2, July 8																	
1	7	mud	5	-	5	13	-	-	-	-	2	9	-	1	30	0.7	0.38
2	27	clay, mud	-	2	4	2	-	-	-	-	8	-	2	18	0.6	0.28	
3	31	sand, mud	-	-	-	-	-	-	-	-	1	7	-	1	20	0.5	0.15
4	28	sand, mud	2	2	11	-	-	-	-	-	1	-	-	-	64	3.7	2.90
5	14	sand, mud	2	2	61	1	2	4	2	-	-	-	-	-	13	0.3	0.22

Appendix Table 2 continued.

Appendix Table 2 continued.

Appendix Table 2 continued.

Numbers per six-inch Ekman Dredge

Number	Bottom Type	Hyalloela	Gammareus	Chironomids	Chaoborus	Ceratopogonids	Sphaeridae	Gastropods	Leeches	Oligochaetes	Caddis L.	Miscellaneous	Total	Volume, ml's.	Wet weight lbs
Devils Lake - cont'd.															
Total		1,364	1,059	2,423	401	576	4	12	4	53	178	-	9	3,660	41.6
Average		34.1	26.5	60.5	10.0	14.4	0.1	0.3	0.1	1.3	4.5	-	0.2	91.5	1.04

Appendix Table 3. Test net catches from three lakes on the Sturgeon River, 1969.

Species	Mesh size, inches						Totals	
	$1\frac{1}{2}$		2		3			
	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.		
Isle Lake								
Pike	-	-	1	2.0	1	3.4	-	
Walleye	23	4.2	22	4.8	-	-	45	
White Suckers	-	-	1	1.6	15	38.5	9.0	
Totals	23	4.2	22	4.8	2	3.6	59.2	
Net Lift 1, June 11, Mean Depth - 22.5 feet								
Pike	-	-	1	2.0	1	3.4	-	
Walleye	23	4.2	22	4.8	-	-	45	
White Suckers	-	-	1	1.6	15	38.5	9.0	
Totals	23	4.2	22	4.8	2	3.6	59.2	
Net Lift 2, June 12, Mean Depth - 11.0 feet								
Pike	7	6.1	46	45.4	47	81.2	-	
Walleye	6	10.7	32	26.5	11	30.4	16	
Perch	13	1.0	14	2.9	1	0.6	-	
White Suckers	1	0.8	-	-	13	15.5	24	
Totals	27	18.6	92	74.8	72	127.7	42	
Net Lift 3, July 10, Mean Depth - 20.5 feet								
Pike	1	1.1	3	3.3	9	18.3	1	
Perch	2	0.2	4	1.2	-	-	-	
Walleye	3	0.8	28	10.9	3	10.2	-	
White Suckers	2	0.6	1	0.3	10	11.0	22	
Totals	8	2.7	36	25.7	22	57.7	14	

Appendix Table 3. Continued.

Species	Mesh size, inches						Totals
	1½	2	3	4	5	5½	
No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.
Net Lift 4, July 24, Mean Depth - 15.0 feet							
Pike	2	3.8	3	5.5	6	10.0	-
Perch	9	0.7	1	0.2	-	-	-
Walleye	8	2.3	6	4.7	1	5.0	-
White Suckers	-	-	1	0.4	-	10.4	3
Burbot	-	-	-	-	-	-	-
Totals	19	6.8	11	10.8	7	15.0	3
						27.0	3
						11.1	52
							82.7
Net Lift 5, August 7, Mean Depth - 10.0 feet							
Pike	10	20.7	18	24.6	20	6.8	1
Perch	37	3.7	19	3.8	2	1.0	-
Walleye	2	0.7	4	1.5	-	-	-
White Suckers	2	5.1	-	-	1	1.5	32
Totals	51	30.2	41	29.9	23	9.3	34
						83.4	24
						84.0	-
							176
							249.1
Lac Ste. Anne							
Net Lift 1, July 11, Mean Depth - 15.5 feet							
Pike	-	-	1	2.6	11	22.4	-
Walleye	-	-	17	16.3	7	7.7	1
White Suckers	-	-	-	-	3	11.3	2.9
Lake Whitefish	-	-	8	2.7	2	46.8	8
Totals	-	-	26	21.6	23	36.4	33
						82.0	19
						56.1	1
							5.2
							102
							202.4

Appendix Table 3. Continued.

Species	Mesh size, inches						Totals		
	1½	2	3	4	5	5½	No. lbs.	No. lbs.	No. lbs.
Net Lift 2, July 15, Mean Depth - 24.0 feet									
Pike	4	5.5	4	6.8	8	12.7	2	5.1	-
Perch	5	0.4	1	0.4	-	-	-	-	18
Walleye	2	1.9	13	8.2	2	4.0	1	2.7	6
White Suckers	-	-	1	1.6	2	3.6	12	26.8	16.8
Lake Whitefish	-	-	-	-	1	0.6	-	12.4	44.4
Burbot	-	-	-	-	-	1	2.3	3.6	7.3
Totals	11	7.8	19	17.0	13	20.9	16	36.9	101.7
Net Lift 3, July 16, Mean Depth - 10.0 feet									
Pike	-	-	4	9.0	8	15.0	1	3.5	-
Perch	5	0.4	-	-	-	-	-	-	13
Walleye	1	0.3	16	19.6	14	29.6	10	25.9	5
White Suckers	-	-	-	-	-	7	16.6	-	0.4
Lake Whitefish	5	2.3	7	3.8	8	7.9	3	6.0	44
Totals	11	3.0	27	32.4	30	42.5	21	52.0	80.8
Net Lift 4, August 13, Mean Depth - 23.0 feet									
Pike	1	2.2	3	5.9	2	4.7	-	-	6
Perch	10	0.8	2	0.4	-	-	-	-	12
Walleye	7	2.0	11	10.5	3	5.4	2	6.5	25
White Suckers	-	-	-	-	5	9.3	25	57.2	26.7
Lake Whitefish	6	1.6	19	5.9	1	0.6	2	2.4	31
Totals	24	6.6	35	22.7	11	20.0	29	66.1	69.5
									13.8

Appendix Table 3. Continued.

Species	Mesh size, inches						Totals	
	1½	2	3	4	5	5½	No. lbs.	No. lbs.
	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.
Net Lift 5, August 14, Mean Depth - 9.0 feet								
Pike	1	1.8	7	11.8	22	49.5	1	1.5
Perch	32	3.4	15	3.3	4	2.7	-	-
Walleye	3	4.9	4	4.4	8	11.7	2	5.3
White Suckers	-	-	1	0.4	-	-	22	51.9
Lake Whitefish	-	-	27	19.9	35	0.9	1	1.9
Totals	36	10.1	27	19.9	35	64.8	26	60.6
						14.7	-	-
Net Lift 6, August 26, Mean Depth - 10.0 feet								
Pike	-	-	2	3.3	11	22.3	1	2.3
Perch	1	0.1	1	0.3	3	2.0	-	-
Walleye	3	4.9	3	1.7	5	4.8	2	5.6
White Suckers	-	-	-	-	-	-	25	63.7
Lake Whitefish	-	-	6	5.3	20	0.7	-	-
Totals	4	5.0	28	29.8	28	71.6	1	2.8
						-	-	-
Devils Lake								
Net Lift 1, July 8, Mean Depth - 27.0 feet								
Burbot	-	-	-	-	-	-	13	31.4
White Suckers	-	-	-	-	-	-	3	7.5
Walleye	-	-	-	-	-	-	-	-
Totals	-	-	-	-	-	-	16	38.9
							8	25.7
							1	5.2
							25	69.8

Continued.

Species	Mesh size, inches						Totals
	1½	2	3	4	5	5½	
No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.	No. lbs.
Net Lift 2, July 22, Mean Depth - 17.0 feet							
Pike	3	3.5	2	2.1	5	5.8	-
Perch	8	1.1	5	0.8	1	1.5	-
Burbot	-	-	-	-	2	5.0	-
White Suckers	-	-	-	-	27	62.8	18
Walleye	-	-	1	3.1	1	1.5	4
Totals	11	4.6	8	6.0	7	8.8	33
Net Lift 3, August 5, Mean Depth - 22.0 feet							
Pike	2	1.8	-	-	3	4.6	-
Perch	2	0.2	-	-	-	-	-
White Suckers	-	-	-	2	3.4	3	8.3
Walleye	4	2.2	-	-	-	-	-
Totals	8	4.2	-	-	5	8.0	3
Net Lift 4, August 29, Mean Depth - 15.0 feet							
Pike	-	-	3	3.4	5	8.5	-
Perch	27	2.9	7	1.1	-	-	-
White Suckers	-	-	-	-	2	5.4	4
Walleye	6	0.7	2	6.8	1	2.9	10
Totals	33	3.6	12	11.3	6	11.4	12

Appendix Table 4. Summary of the commercial fishing harvest, in pounds, on Lac Ste. Anne, 1942-1970.¹

Season	No. of Licenses	Lake Whitefish	Pike	Perch	Walleye	Total
1942-43	41	50,623	3,239	-	1,765	55,627
1943-44	9	55,449	-	-	-	55,449
1944-45	128	60,303	-	-	-	60,303
1945-46	139	104,260	-	-	800	105,060
1946-47	176	88,951	367	205	17,478	107,033
1947-48	89	45,975	729	-	6,423	53,384
1948-49	67	26,442	200	-	13,161	39,803
1949-50	95	38,641	45	-	833	39,519
1950-51	76	43,004	840	-	3,336	47,180
1951-52	74	64,587	1,379	-	3,369	76,298
1952-53	117	61,780	900	-	720	68,900
1953-54	144	170,412	1,284	-	5,640	179,212
1954-55	671	373,760	2,680	-	4,545	400,985
1955-56	256	102,000	-	-	-	102,000
1956-57	465	63,420	360	-	180	68,960
1957-58	313	51,840	360	-	240	56,861
1958-59	310	90,682	7,110	-	2,558	138,400
1959-60	426	151,276	3,439	-	6,866	208,991
1960-61	349	50,240	3,540	-	3,325	63,466
1961-62	155	43,940	1,285	-	7,320	102,920
1962-63	93	18,480	125	-	360	21,009
1963-64	85	28,149	750	-	30,507	59,406
1964-65		Season closed				
1965-66	62	11,150	900	-	6,160	18,210
1966-67	100	13,000	800	-	1,200	16,700
1967-68	72	22,887	927	-	1,115	26,257
1968-69	29	15,757	487	-	293	18,667
Average	175	71,039	1,443	7.9	4,546	84,254
Average since 1965	66	15,698	779	-	1,941	19,958

¹ Records from Alberta Fish and Wildlife Division.

Metric Tables

Table 7. Average wet and dry weight, volume, numerical percentages, and average number per square meter of bottom fauna from three lakes on the Sturgeon River, 1969.

Number of Dredgings	Average Wet Weight, kg/ha	Average Dry Weight, kg/ha	Average Volume, m³/ha	Average Number Per Square meter										
				Hyalidea	Gemmara	Total	Amphipods	Chironomids	Ceratopogonidae	Sphaeriids	Gastropods	Leeches	Oligochaetes	Crustaceans
Isle Lake														
47	418.2	54.4	6.3	193.7	292.7	486.4	1,028.7	185.1	25.8	38.7	12.9	94.7	-	- 1,883.0
Percentage				10.3	15.4	25.7	54.6	9.8	1.4	2.1	0.7	5.0	-	-
50	644.6	83.8	7.6	675.7	637.0	1,312.7	929.7	2.2	4.3	94.7	60.3	90.4	4.3	8.6 2,612.5
Percentage				25.9	24.5	50.4	35.6	0.1	0.2	3.7	3.7	3.5	0.2	0.3
26	451.4	58.7	6.1	4.3	-	4.3	934.0	245.3	51.6	60.3	-	4.3	62.4	- 2.2 1,373.0
Percentage				0.3	-	0.3	68.2	18.1	3.8	4.5	-	0.3	4.6	- 0.2
76	559.4	72.6	7.2	447.6	417.5	865.1	929.7	86.1	2.2	81.8	60.3	4.3	90.4	4.3 2,190.7
Percentage				20.4	19.2	39.6	42.4	3.9	1.0	3.8	2.8	2.0	4.1	0.2 0.2
40	421.8	54.8	4.7	1,467.7	1,140.6	2,608.2	430.4	619.8	4.3	12.9	4.3	56.0	193.7	- 8.6 3,938.2
Percentage				37.3	29.1	66.4	10.9	15.7	0.1	0.3	0.1	1.4	4.9	- 0.2

1 Dry weight = 13% of wet weight.

Table 10. Fork lengths and weights at age of six species of fish from three lakes on the Sturgeon River, 1969.

No. of Annuli	Isle			Lac Ste. Anne			Devils		
	Average length, centi- meters	Average weight, grams	Sample size	Average length, centi- meters	Average weight, grams	Sample size	Average length, centi- meters	Average weight, grams	Sample size
Pike									
0	-	-	-	-	-	-	-	-	-
1	35.1	23.5	10	45.6	50.1	5	-	-	-
2	47.0	59.1	84	51.2	71.9	23	49.0	79.2	18
3	58.0	103.6	26	54.1	86.9	23	55.8	101.9	1
4	64.2	137.3	11	58.9	107.0	28	-	-	-
5	73.3	195.3	3	63.7	135.0	5	-	-	-
6	-	-	-	67.9	162.7	1	-	-	-
7	-	-	-	71.3	169.8	1	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	110.1	720.0	1
Walleye									
0	-	-	-	-	-	-	10.2	0.8	1
1	18.7	5.4	4	21.2	7.1	4	20.1	30.6	5
2	24.9	11.6	96	29.7	20.1	44	-	-	-
3	32.3	38.8	6	37.1	40.8	30	-	-	-
4	44.7	75.8	5	43.3	67.4	7	43.9	69.3	2
5	50.1	100.5	13	48.1	95.9	11	50.1	106.4	4
6	54.9	141.5	11	50.1	107.3	15	52.6	125.4	5
7	57.7	157.6	13	52.9	127.1	19	54.3	133.9	6
8	60.3	178.0	8	54.9	141.8	7	56.0	142.3	10
9	72.4	294.3	1	58.9	170.9	4	59.1	164.4	5
Perch									
0	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-
2	14.7	3.4	24	13.9	2.8	2	15.3	3.7	8
3	17.0	5.4	30	15.8	3.7	25	17.5	5.9	17
4	20.9	9.9	15	19.2	6.8	19	19.5	7.9	4
5	23.8	13.6	7	21.8	9.9	6	-	-	-
6	29.4	26.9	1	25.5	16.1	1	24.9	25.5	1
7	30.0	28.3	2	30.3	30.0	4	-	-	-
8	-	-	-	30.6	29.7	4	-	-	-
9	-	-	-	-	-	-	34.3	66.5	1

Table 10. Continued.

No. of Annuli	Isle			Lac Ste. Anne			Devils		
	Average length, centi- meters	Average weight, grams	Sample size	Average length, centi- meters	Average weight, grams	Sample size	Average length, centi- meters	Average weight, grams	Sample size
Lake Whitefish									
0	Not present			-	-	-	Present but not caught		
1				19.3	8.8	21			
2				26.4	24.1	33			
3				33.5	51.5	9			
4				40.4	87.7	3			
5				43.2	114.9	14			
6				45.7	140.4	14			
7				48.0	156.3	3			
White Suckers									
0	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-
2	23.9	21.2	6	-	-	-	-	-	-
3	30.2	45.0	13	36.6	75.8	9	39.1	100.7	6
4	39.4	94.8	20	40.4	98.2	27	41.7	106.4	18
5	43.4	121.7	55	43.9	122.5	28	45.2	128.5	20
6	48.3	167.5	47	47.8	150.3	12	47.8	150.3	7
7	-	-	-	-	-	-	50.5	174.9	5

Table 11. Length-weight and length-frequency relationships of five species of fish from three lakes on the Sturgeon River, 1969

Fork Length, Centimeters	Isle						Lac Ste. Anne						Devils					
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.
Pike																		
27.9	17.0	15.6	18.4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30.5	23.5	21.2	26.9	3	-	-	-	-	-	-	-	-	25.5	25.5	25.5	1	-	-
33.0	31.1	25.5	39.6	11	-	-	-	-	-	-	-	-	28.3	28.3	28.3	1	-	-
35.6	36.2	31.1	41.0	21	34.0	34.0	34.0	1	-	-	-	-	-	-	-	-	-	-
38.1	48.1	42.5	56.6	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40.6	53.8	48.1	70.8	28	54.3	49.5	84.9	5	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3	45.3
43.2	70.8	56.6	124.5	29	65.1	58.0	73.6	13	50.1	41.0	56.6	7	-	-	-	-	-	-
45.7	85.7	69.3	89.1	17	75.0	65.1	84.9	17	63.1	53.8	69.3	6	-	-	-	-	-	-
48.3	89.1	77.8	109.0	9	92.0	76.4	110.4	22	69.9	58.0	84.9	5	-	-	-	-	-	-
50.8	101.0	90.6	141.5	9	97.1	84.9	110.4	15	84.9	84.9	84.9	1	-	-	-	-	-	-
53.3	115.7	111.8	120.3	5	111.2	96.2	127.4	7	99.1	96.2	101.9	2	-	-	-	-	-	-
55.9	126.5	107.5	147.2	9	125.4	104.7	144.3	8	-	-	-	-	-	-	-	-	-	-
58.4	157.6	155.7	159.9	2	144.3	127.4	167.0	2	-	-	-	-	-	-	-	-	-	-
61.0	-	-	-	-	-	162.7	162.7	1	-	-	-	-	-	-	-	-	-	-
63.5	198.1	198.1	198.1	1	169.8	169.8	169.8	1	-	-	-	-	-	-	-	-	-	-
66.0	193.9	184.0	203.8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
96.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 11. Continued.

Fork Length, Centimeters	Weight, Grams										Devils Isle
	Lac Ste. Anne					Walleye					
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.
7.6	-	-	-	-	-	-	-	-	0.8	0.6	0.8
10.2	-	-	-	-	-	-	-	-	-	-	-
12.7	-	-	-	-	-	-	-	-	3.7	3.7	3.7
15.2	4.8	4.2	5.7	4	5.7	5.7	5.7	1	4.5	4.2	4.5
17.8	7.1	5.7	7.6	12	7.1	5.7	7.6	2	-	-	-
20.3	9.9	6.5	12.2	47	9.9	9.6	10.5	2	-	-	-
22.9	13.9	11.3	16.1	33	15.6	11.3	24.1	12	-	-	-
25.4	18.1	15.6	19.8	11	19.5	16.1	22.6	20	-	-	-
27.9	-	-	-	-	24.6	20.7	29.7	10	-	-	-
30.5	-	-	-	-	33.1	29.7	38.2	16	-	-	-
33.0	43.9	36.8	52.6	3	40.5	34.0	48.1	15	-	-	-
35.6	-	-	-	-	54.6	49.5	62.3	6	-	-	-
38.1	65.9	59.4	69.3	3	58.0	58.0	58.0	2	69.3	69.3	69.3
40.6	85.7	75.0	92.0	3	79.2	76.4	100.5	11	80.7	69.3	92.0
43.2	107.5	86.3	127.4	11	105.6	90.6	123.1	17	106.7	97.6	118.9
45.7	117.7	86.3	141.5	8	122.5	104.7	140.1	22	123.7	116.0	135.8
48.3	142.9	118.9	159.9	11	141.5	121.7	152.8	9	138.7	93.4	155.7
50.8	164.1	134.4	193.9	15	165.0	155.7	189.6	4	148.6	140.1	171.2

Table 11. Continued.

Fork Length, Centimeters	Weight, Grams										Devils Isle
	Isle			Lac Ste. Anne			Walleye (cont'd)				
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.
Walleye (cont'd)											
53.3	196.7	164.1	212.3	7	175.5	175.5	175.5	1	158.5	147.2	188.2
55.9	195.3	164.1	226.4	2	-	-	-	-	-	-	-
58.4	-	-	-	-	-	-	-	-	-	-	-
61.0	-	-	-	-	-	-	-	-	-	-	-
63.5	294.3	294.3	294.3	1	-	-	-	-	-	-	-
Perch											
7.6	0.8	0.8	0.8	1	-	-	-	-	-	-	-
10.2	2.8	2.8	2.8	2	-	-	-	-	-	-	-
12.7	3.4	2.8	4.2	46	3.7	2.8	4.8	36	4.2	2.8	4.8
15.2	5.7	4.2	8.5	18	5.7	4.2	7.1	18	6.2	4.8	7.6
17.8	9.1	7.1	12.2	24	9.3	7.6	10.5	13	9.3	8.5	9.3
20.3	11.6	7.6	14.2	5	11.6	10.5	12.7	3	-	-	-
22.9	19.0	18.4	19.8	2	16.1	16.1	16.1	1	25.5	25.5	25.5
25.4	27.7	26.9	28.3	3	29.7	25.5	34.0	5	-	-	-
27.9	-	-	-	-	28.0	25.5	31.1	3	-	-	-
30.5	-	-	-	-	-	-	-	-	-	-	-
33.0	-	-	-	-	-	-	-	-	66.5	66.5	66.5

Table 11. Continued.

Fork Length, Centimeters	Isle							Weight, Grams						
	Lac Ste. Anne			Devils				Lake Whitefish						
	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.
Not present														
15.2					7.1	7.1	7.1	1						
17.8					6.2	7.4	9.9	14						
20.3					10.2	9.3	11.3	6						
22.9					20.7	19.8	23.5	4						
25.4					23.5	18.7	28.3	23						
27.9					29.7	28.3	31.1	6						
30.5					43.3	39.6	45.3	3						
33.0					46.7	42.5	52.4	3						
35.6					63.7	62.3	66.5	3						
38.1					86.9	84.9	89.1	2						
40.6					121.7	90.6	164.1	9						
43.2					135.8	117.4	147.2	10						
45.7					137.8	120.3	158.5	10						
48.3					162.7	161.3	164.1	2						

Table 11. Continued.

Fork Length, Centimeters	Weight, Grams										
	Isle			Lac Ste. Anne			Devils				
Mean	Min.	Max.	No.	Mean	Min.	Max.	No.	Mean	Min.	Max.	No.
White Suckers											
20.3	19.0	19.0	1	-	-	-	-	-	-	-	-
22.9	35.4	15.0	59.4	5	-	-	-	-	-	-	-
25.4	-	-	-	-	-	-	-	-	-	-	-
27.9	38.8	31.1	45.3	8	-	-	-	-	-	-	-
30.5	52.4	36.8	90.6	10	-	-	-	-	-	-	-
33.0	60.3	56.6	67.9	3	65.9	65.1	66.5	2	-	-	-
35.6	-	-	-	-	76.4	67.9	84.9	4	72.2	59.1	79.0
38.1	94.8	73.6	145.7	22	92.5	73.6	113.2	34	89.1	83.5	106.1
40.6	103.9	73.6	121.7	46	103.3	86.3	121.7	55	105.6	82.1	120.3
43.2	125.4	107.5	159.9	26	127.4	103.3	155.7	22	130.2	92.0	154.2
45.7	152.0	124.5	171.2	34	137.8	127.4	147.2	10	145.7	79.2	169.8
48.3	176.3	141.5	195.3	42	159.3	150.0	169.8	3	158.5	142.9	181.1
50.8	197.3	169.8	237.7	9	-	-	-	-	180.3	171.2	184.0
53.3	195.3	195.3	195.3	1	-	-	-	-	-	-	-

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